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Getting Rid of Chips — Milling Machine Manufacture — Milling Worms — Manufacturing Sectors — Machine Screws — Correcting an Index Screw.

If a machinist has occasion to take apart any of the cheaper class of machine tools, the chances are that he will find in various pockets about the machine a collection of iron chips that have been deposited therein during the process of construction, and which the builder has made it no one's business to remove. Sometimes these chips do no particular harm; but, on the other hand, they sometimes do; and whether they do or not, the fact remains that when a machinist discovers one of these deposits he always feels as though the machine had been slammed together without much regard to the niceties of construction, and one instinctively feels that it is somehow wrong when selling a machine to throw in with it a lot of the chips made in its construction. A good mechanic may think that fierce competition forces him to neglect such little refinements as their thorough removal, but he never feels just right about it. They are especially objectionable when mixed with oil and packed at the bottom of tapped holes, and to remove them is not as easy as it looks.

It is done very easily in the shop of the Kempsmith Machine Tool Company, at Milwaukee, however, because they have special facilities for the work, and I daresay that the prompt removal of the chips there really facilitates other operations, and decreases rather than increases prime costs.

In one corner of the shop, near the engine room, stands a substantial wooden tank within which is a coil of steam pipe, and in the tank is "soda water." By the steam coil this is kept hot at all times, and when there are chips to be removed from tapped holes in any part of a machine, or oil is to be cleaned from it, the piece is taken to this tank, immersed for a few moments, and perhaps a syringe or squirt-gun used for washing out the tapped holes. The heat is high enough so that the piece rapidly dries off when taken out, and subsequent work upon it is often materially facilitated by this thorough cleaning.

This shop contains a good many other interesting things. It is owned and managed by a thorough-going mechanic—an old shopmate of mine—who seems determined, first of all, to have things right, and who wouldn't be able to sleep well unless he firmly believed they were so.

TOOLS FOR BUILDING MILLING MACHINES.

This shop also is able to introduce those special features which are justified

A JOB OF MACHINE WORK.

by the fact that practically only one thing is produced within its walls. In this case it is milling machines, and the shop and its equipment are both strictly adapted to that one product, and special tools are provided for each style of machine.

In this tool room a somewhat unusual classification of tools was noticed; *all* the tools and fixtures used in the production of a given machine being in a cupboard by themselves and kept together, including not only those which could be used for no other machine, but those also which could be used as well on others; practical or perhaps exact duplicates of them being found in the cupboards devoted to the tools for those others.

Though this involves some extra investment in tools, it is found to conduce to economy of production in other ways. Tools can always be had when wanted, and there is always opportunity for inspection and repairs or renewal in the intervals between periods of activity for any given set of tools.

Each set of tools, I noticed, included a set of testing gages to fit over the knee and other portions of the machine, and fitted to show, by the reading of a micrometer screw, just how near an approach to perfect alignment has been secured.

MILLING THE THREADS OF WORMS.

Being a milling machine man, Mr. Kempsmith "takes his own medicine" and uses the machine in his own shops in interesting ways not commonly encountered. He uses a good many worms and cuts them in a standard milling machine by aid of a special fixture, which holds the blank on a spindle, a portion of which spindle is threaded the same pitch and feeds through a nut when revolved by the feed mechanism. Worms are thus produced about four times as fast as is possible to make them in the lathe, and by relatively unskilled labor, though the ones used for indexing are finished in a lathe for the sake of the higher degree of accuracy thus attained.

MANUFACTURING INDEX PLATE SECTORS.

Another job which I was greatly interested in was the production of "sectors" for the index plates of milling machines. A picture of one of these just as it came from the tools is shown herewith. It will serve to give an idea of the work but will not, I suppose, make plain the fact that no hand work whatever has been done upon the two pieces composing it, except to remove a burr here and there with a file. The surfaces are otherwise just as the tools left them, and the sector is practically completed; needing only a little smoothing by hand with emery-cloth and to be drilled and tapped for the clamping screw.

This job is fairly representative of the shop, and I am glad to be able to pre-

sent some drawings showing just how it is carried through.

At Fig. 1 is shown the punched blanks of steel, the two pieces being alike, with the exception of a difference in diameter of the hole through the center. At Fig. 2 is a drawing of the finished sector with figures giving sizes.

The first operation is to mill the rough blanks to exact thickness, which is done by the ordinary spiral mill, the blanks being held in vise jaws specially adapted to the form of the piece.

They are then roughed out in a turret machine in the manner shown in Fig. 3, which shows a piece held on a special face-plate made to receive it and with

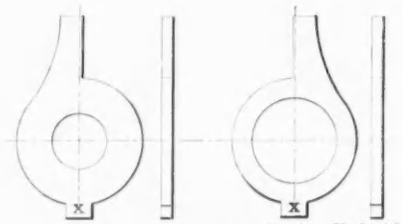

Fig. 1

THE PUNCHED BLANKS.

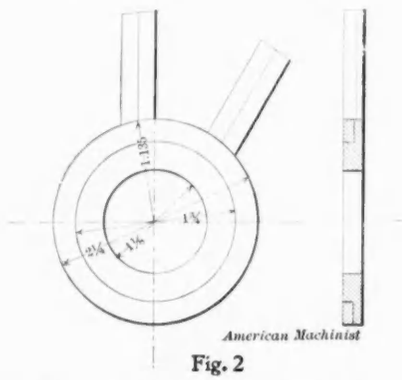

Fig. 2

DRAWING OF FINISHED SECTOR.

shown, in a socket which fits the hole in the turret, and the socket carries also the tool for cutting the counterbores which let the pieces together.

Reference to Fig. 3 will show that the blank end, guide, or pilot of the reamer first enters and is supported by a bronze bushing in the end of the spindle. By the further advance of the reamer the hole is then reamed to 1.115 inch, and next a second guide or pilot formed upon the reamer and which is 1.114 inch diameter, enters the reamed hole, and prevents any shifting of work or of tool while the counter-boring is being done by the single tool shown.

Fig. 4 gives two views of the finishing tool for this operation, with diameters marked on it, and also the reamers for the

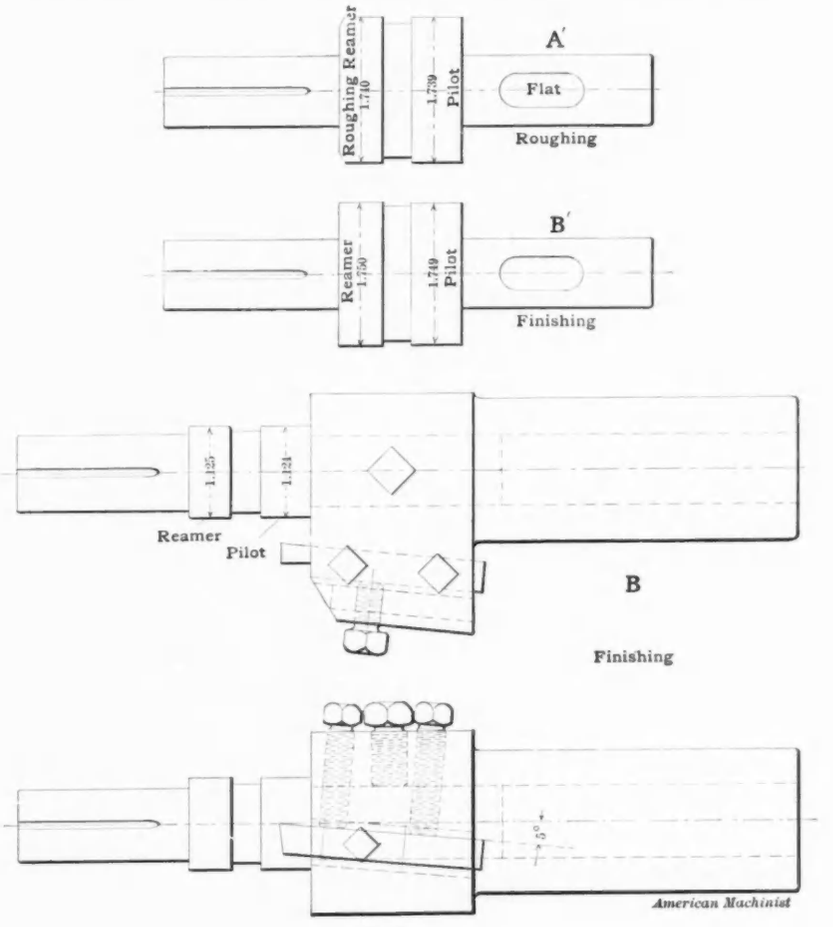

Fig. 4

REAMER AND COUNTERBORING TOOL.

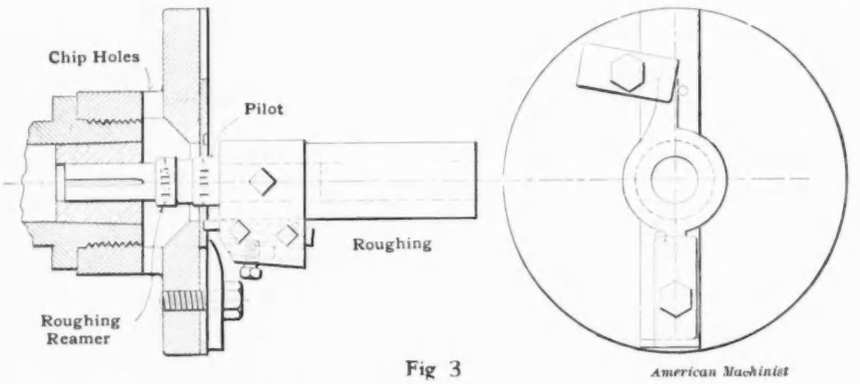

Fig 3

REAMING AND COUNTERBORING SECTORS.

special arrangements for getting rid of chips, and, in short, doing a good job expeditiously. The hole is first roughed out with a reamer like that shown separately at A^1, Fig. 4, which is for the piece with the larger hole. This reamer is held, when in use, by a set-screw, as

pieces with the larger hole. Only two of the turret holes are used on this job, one for the roughing and the other for the finishing operation. It will be noticed that the ends of the reamers which act as guides have four semi-circular grooves milled in them, and these are regarded as important aids in avoiding trouble with chips.

The lugs *x* shown in Fig. 1 are only for use in clamping the pieces as shown in Fig. 3, and as their usefulness is now ended, they are next milled off with an end mill, the pieces being held in plain vise jaws.

Fig. 5 shows the next operation, which is to mill the fingers and the part of the outer circle immediately adjacent to them, the pieces being held six at a time in special cast-iron jaws, provided with means for accurately centering them. Two similar operations are performed here, one for the inner and the other for outer edge of the fingers, as indicated by the dotted outlines at the right of Fig. 5.

The next operation is to mill the re-

mainder of the outer circle. This is done in the manner shown in Fig. 6, and finally in the manner indicated in Fig. 7 the bevel on the fingers is milled, the pieces being held in special steel jaws, one of which has a recess adapted to receive and hold the finger in the proper position, while the other has a projecting horn or beak which, as the vise is closed, passes over and firmly seats the piece.

These tools are all admirably constructed; they work well and produce a job which constitutes a very interesting example of what can be done in that line by going about it in the right manner, with an intelligent appreciation of the degree of refinement required, and the knowledge of how to construct the tools and fixtures.

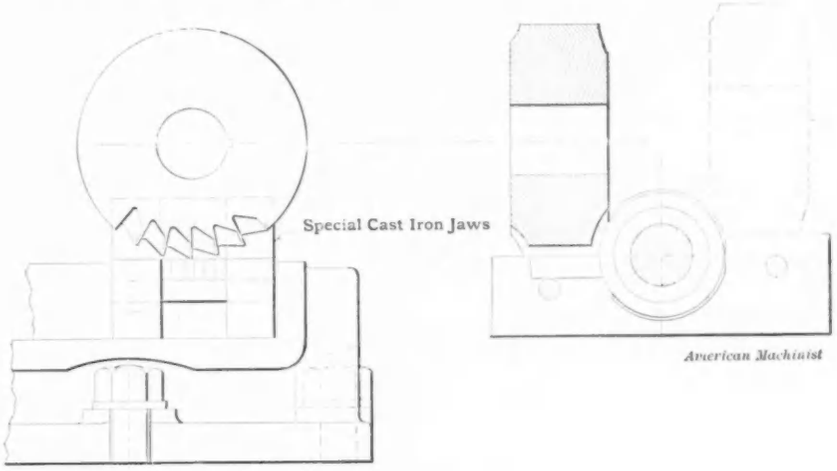

Fig. 5

MILLING FINGERS.

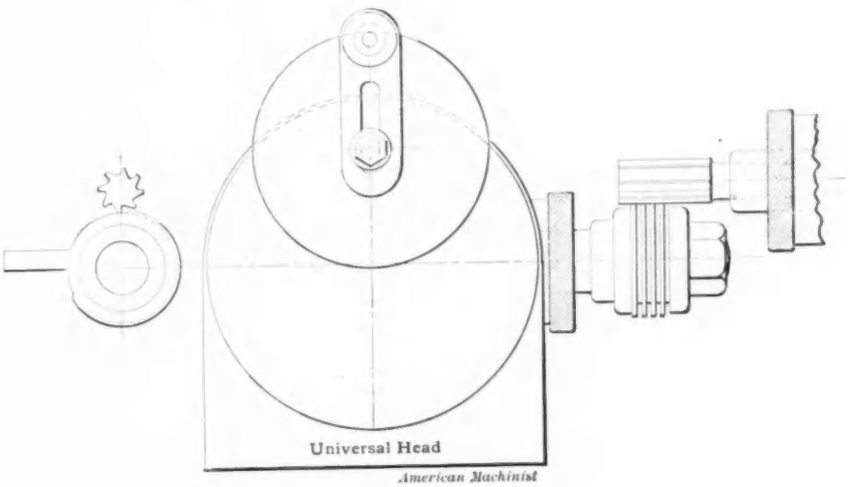

Fig. 6

MILLING OUTSIDE OF CIRCLE.

MACHINE SCREWS, GOOD AND BAD.

The treatment of the machine-screw question in this shop is typical of what is done quite generally by the best tool-building shops. They are making their own screws because they cannot buy screws they consider to be up to their standard of workmanship. Mr. Kempsmith said he used commercial screws, and had persistently tried to buy them of good enough quality for his work. He had finally given it up in disgust, and he showed me some of those he had bought and some of his own manufacture; nominally the same. The difference in general neatness and finish was very marked in favor of the latter, and I was informed that in respect of uniformity of size there was equal superiority. They are made on a hand-operated screw machine, one such machine and its operator being just about kept busy in making all the screws for the establishment. Cold-drawn steel is used for stock, which steel is sufficiently accurate in size and shape, whether round, square or hex., to make the head of the screw correct without further attention, this fact making the extra price paid for it justifiable.

We all know, of course, that between the cost of making screws in this way and that of making them by the bushel by means of automatic screw machines there is room for a good profit, and it would seem to me that some of our screw-making establishments might do well to look into this thing and see if it would not pay to supply a higher grade of screws to those whose work requires them. This would mean only a little closer looking after tools used in the automatics and a little more careful inspection of the work; and the extra cost of it would undoubtedly be gladly paid by many of those who know that good, well-finished screws, free from burrs and evidences of dull and over-worked dies, etc., go very far toward making a favorable impression on purchasers of machinery.

By a familiar process of evolution, the present grade of screws, which would then be the "seconds," would grow worse and worse with a corresponding increased demand for the first quality; but that is a matter which may be left to take care of itself, the main fact being that there is now some demand for first-class, high-grade screws, and that this demand could probably be easily increased by educational work.

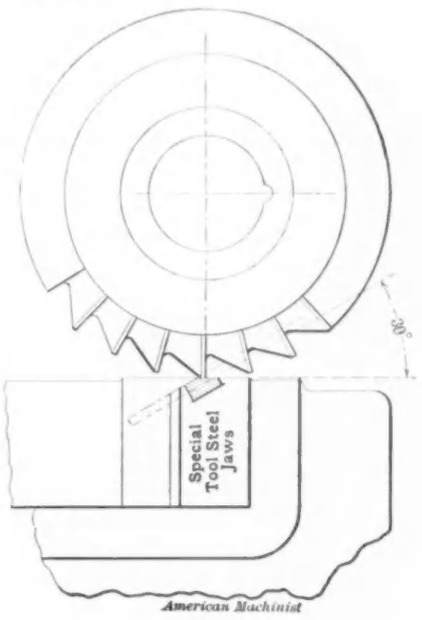

Fig. 7

A MILLING OPERATION.

MAKING A SCREW CORRECT AFTER IT IS CUT.

The discussion regarding elevating screws for planers, and the best method of readily getting them sufficiently accurate for what they have to do, reminds me of a trick I saw at the shops of Gould & Eberhardt some time ago. It was not for the purpose of cutting accurate screws, but for making them accurate after being cut, and when a test had shown them to be not quite up to the required degree of precision. In this case the screws were for moving the table of a rack cutter, and the accuracy of the racks cut

by the machine depends mainly upon the accuracy of this screw, which never moves the table when under cut and has no very great resistance to overcome, but must move the table a distance precisely equal to the calculated pitch of the rack being cut, or some multiple of it.

They have a precision screw for cutting such screws, but for some reason they found one of these rack-cutter indexing screws a little too fine in pitch near one end, and they stretched it to the exact pitch by means of the device shown in Fig. 8. This is a hardened steel roller with a slightly rounded edge and a little thinner than the space between the threads of the screw. It is fitted to revolve freely on a pin fitted to a shank, which shank is held in the tool post of a lathe and fed along by the lead-screw, the same as in cutting the thread; and, being pressed against the screw at the bottom of the thread, it stretched it sufficiently to bring it up to the standard.

I do not know how much stretching might be done in this way—perhaps a good deal—but in this case the amount required was very small. To facilitate the operation, a special gage was made which is sketched at Fig. 9. This is mainly of

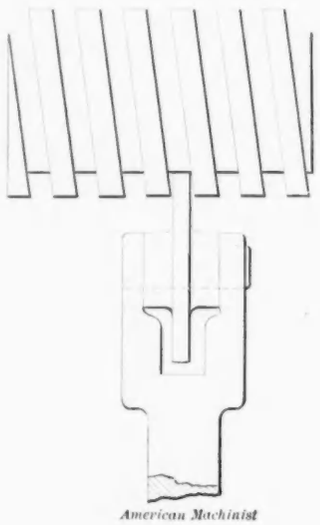

Fig. 8

STRETCHING A SCREW.

wood and is applied to the screw in the manner shown, the two steel gage pieces having been previously set precisely to a certain multiple of the pitch, by means of a standard scale. They are made to accurately fit the thread, are thin, so that light freely passes their edges when in place if there is an opening between them and the thread being tested. The pieces A A^1 are half the diameter of the screw below the gage pieces, so that they facilitate gaging parallel to the centre line of the screw, and are placed outside so that nothing interferes with the light which leaks through if there is the least inaccuracy. Thus equipped, it was found an easy matter to make the screw precisely right.

Of course, it is easy to say that the proper plan is to cut screws right in the first place and avoid the necessity for such remedies, but a good deal depends upon what is right, and possibly some of those who are now making screws right, according to their standard, and who think it a very easy matter to do it, would find the problem a very different one if the admissible limit of error were reduced, say, one half or more. The difficulties of producing really exact long

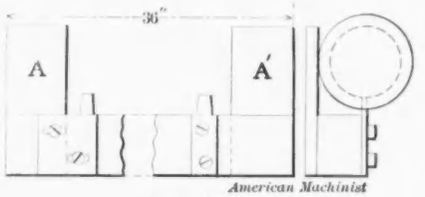

Fig. 9

SCREW PITCH TESTING GAGE.

screws seem to increase in inverse geometrical ratio to the permissible limit of error.

I do not know what would have been done had the screw proven to be a little too long, instead of too short, but years ago I knew a son of the "Emerald Isle" who would have been ready with a remedy for this. He presided over a bolt-cutter, and along with his regular work cut such special bolts as we machinists might require from time to time. I approached him one day, and by such blandishments as experience had shown to be effective in such cases induced him to stop on a regular job long enough to cut for me six 5/8 bolts, 10 threads. When I got the bolts they were cut 11 threads, and upon petitioning for a rehearing, I was informed "wan thread is a shmall matter to be kicking about. Cudn't you just have wan of the byes cut off wan of dthose threads?"

S. T. FREELAND.

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Imported Designs.

"Although all new ships for the United States are required by law to be constructed of American material and by American labor, the same patriotic and independent policy cannot, apparently, be adhered to in the matter of the design of the vessels. Considerable interest, says a New York correspondent, has been evolved by the announcement that the two torpedo boats for which the Bath Ironworks, of Bath, Me., recently received the contract, will be constructed from plans drawn by Professor Biles, the English expert, and designer of the American Line steamships 'Paris' and 'New York.' This has been openly admitted by General Hyde, president of the Bath Ironworks, and it is recalled that on the recent visit of Professor Biles to the States, he spent considerable time at Bath, as also that last year General Hyde spent considerable time himself in Great Britain in consulting with eminent shipbuilders and naval architects."—"The Engineer," London.

History will, of course repeat itself. Wasn't it the notorious "Texas," also of our navy, that was built on British plans? We believe it was not Professor Biles who designed the "St. Paul" and the "St. Louis" of the American Line. So we have only to wait a little while for the next chapter of torpedo-boat history.

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An American Blowing Engine for Austria.

There are those who entertain the opinion that it is only in the lighter classes of machinery that we can do any business in foreign countries, and on that account the blowing engine which we illustrate on the opposite page may have some interest aside from its intrinsic interest as a noble example of machine design and construction.

This engine is one of two recently built by the E. P. Allis Company, of Milwaukee, Wis., for the new furnace plant of the Krainische Industrie Gesellschaft at Triest, Austria, and is identical with some of its predecessors which have been built by the same company for the Carnegie Steel Company and the Sloss Iron & Steel Company, of Birmingham, Ala.

The total hight of the machine as shown is 32 feet. The high pressure cylinders are 40 inches diameter, and the low pressure 78 inches diameter; these latter being, we understand, the largest cylinders of the Corliss type ever made in this country. The air cylinders are 76 inches diameter, and the stroke of all is 60 inches.

The main shaft is 24 inches diameter, with journals 20 x 36 inches; crank-pin 12 x 12 inches. Steam and exhaust pipes are, respectively, 12 inches and 22 inches diameter, and the bed-plate alone weighs 64,000 pounds, being 10 feet wide, 24 feet long.

The fly-wheels for these machines are to be made on the other side, and are, for that reason, not shown in the photograph.

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Our contemporary, "The National Engineer," remarks: "Condensation pays only when water is cheap." This used to be true enough, but it does not square very well with modern practice, which shows that condensing engines can be operated upon a smaller total consumption of water than non-condensing engines can be.

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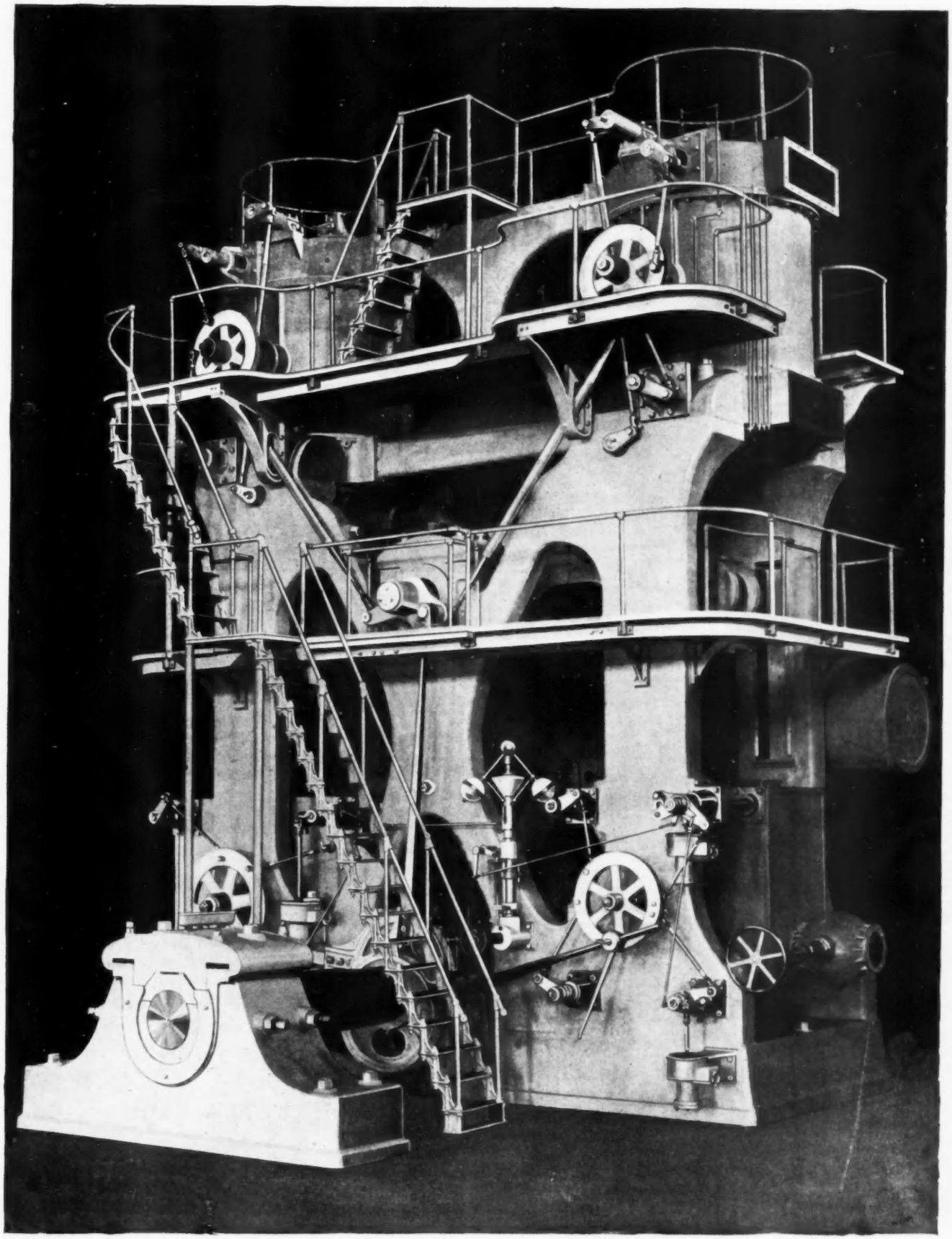
"Pushpen is a ready writer, isn't he?" "Yes; he writes readily enough; but the trouble is he can't think."—"Chicago Record."



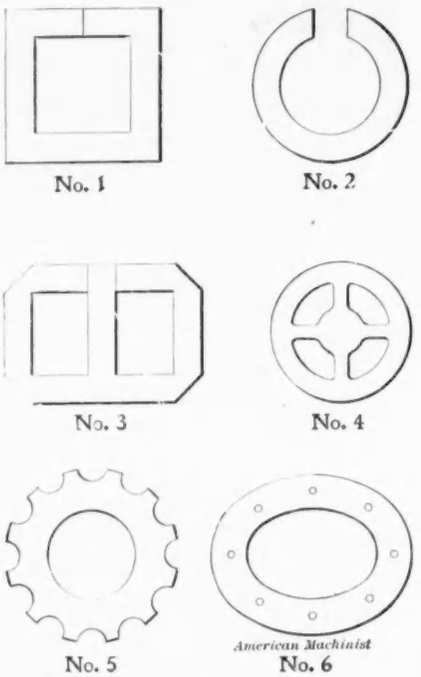
AN AMERICAN BLOWING ENGINE FOR AUSTRIA.

Compound Dies.

BY J. L. LUCAS.

As many readers of the "American Machinist" may not be familiar with the making and using of compound dies, a little information on the subject may be of interest to them. The subject is one in which I am greatly interested, both financially and otherwise, and I am always glad to give or receive any information on them.

A compound die is, as the word indicates, a compound of a die and punch; or, to speak more clearly, the upper half consists of a punch set inside of a die, and the lower, or bottom half, of a die set into a punch; the punch cutting the outside diameter of the blank, which is at the same time pierced in the center by the upper punch, thus finishing a blank at one stroke of the press, that would otherwise require two or more operations.



WORK OF COMPOUND DIES.

The work from a die of this class is far better than when done by the ordinary gang or double die, as the accuracy of the work depends on the care with which the die is made, and not on the skill of the operator. The compound die is especially efficient when used on mica, paper or other substances that do not admit of the use of a gang die; also on work that must be practically perfect, as the blanks for watch and clock movements, sheet-iron disks for electric armatures, and other work where the relation of the center or other holes to the outside diameter must be correct.

The invention of the compound die, and the adaptation of the same to the finer grades of work, as watch and clock movements, is due to A. L. Denison, of Waltham, Mass., and was used in connection with the sub-press, also designed by him.

The die shown in Fig. 1 is a washer die, intended for cutting washers of scrap mica, the center punch *A* piercing the hole at the same time that the outside is being cut by the die *B;* and as a perfect washer is punched out of scrap mica at each stroke of the press, the advantage in using it can be easily seen. In work where the stock is too heavy to admit of the use of springs, the press is fitted with a "knock-out" for the lower and upper dies, thus doing away with the use of springs. The pressure required to strip a complicated piece of work from the press is very great. On a test lately made with a die of 16 inches diameter, and containing 274 inches of cutting edge, the force required was between 3,500 and 4,000 pounds; thickness of stock, .025 inch sheet iron.

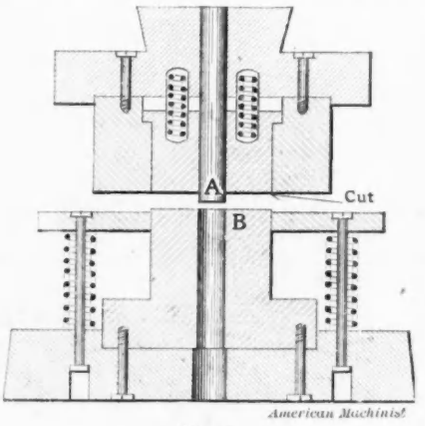


Fig. 1

COMPOUND DIE.

The phenomenal growth of the electrical industry in the last few years, and especially in the use of notched or slotted sheet iron disks for the armature core, has stimulated the invention and use of compound dies of large diameter and complicated designs. The modern armature resembles somewhat a gear that is built up of thin sheet iron plates or disks, usually about .010-inch to .040-inch thick, and from 12 inches to 100 inches diameter. These are, in the best of armatures, punched from the sheet iron, with the center holes and keyway and the teeth, or, as they are called, "the winding slots," at one stroke of the press; the smaller ones in a complete disk, and the larger sizes in as large sections as it is possible to procure the iron; and as some of the styles are very intricate, the ingenuity of the die-maker has been taxed to the utmost to produce what is wanted.

The method first adopted was to blank out the plain sheets, and then put in the center hole and keyway on a separate die. The sheets were assembled on the shaft and turned to size in the lathe; the slots for the winding coils were then cut in the milling machine, and the core was ready to wind. It was very soon found that the contact of the sheets caused by the milling process was detrimental to the electrical efficiency of the armature, and the use of the dial feed press was adopted for punching the slots before the sheets were assembled on the shaft. This gave fairly good results, except that the irregularities of the punched sheets required a good deal of filing to correct them, the effect of which was the same as that caused by the milling process, except to a less extent. This led to the development of compound dies that would punch the sheets out so perfectly that they could be assembled on the shaft or spider, and the armature wound without any further labor being expended on it.

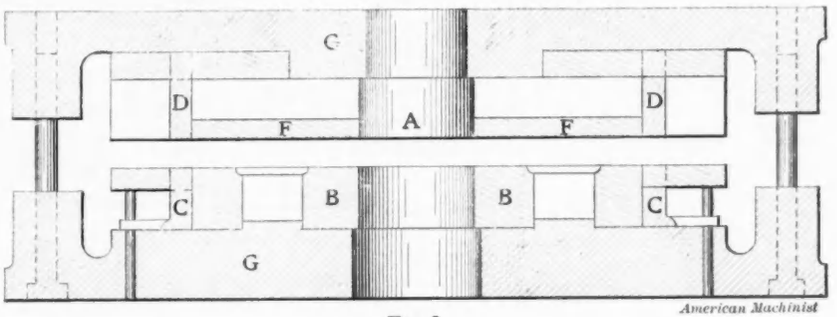


Fig. 2

COMPOUND DIE.

The die shown in Fig. 2 is a style much used for armature work; the diameters vary from 12 inches to 24 inches, and the number of winding slots from 12 to 120, and they are made both with and without the bolt holes. The design of the die is well shown in the cut, which is a cross-section, the punch *A* cutting the center hole, while the small punches *D D D D* at the same time cut the slots around the edge

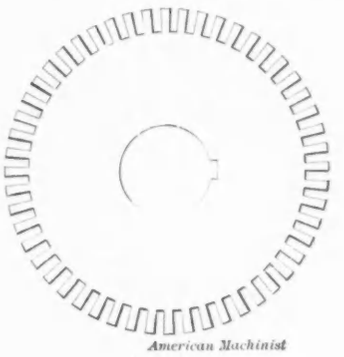


Fig. 3

PUNCHED AT ONE STROKE.

of the sheet. After being punched, the sheet is removed from the dies by the stripper *F*, which is forced down by striking a pin not shown in the cut. The die is built up in sections, there being some 300 pieces (not including screws or springs) in the die shown, and is set into a steel casting *G*, cast iron being found unequal to the strain; the punch *A* and die *B* are hardened and ground to size; the dies *D D D D* are set in a steel holder after being hardened, and are then ground to size. The disk shown, Fig. 3, is a punching from the die.

A die of this style can be made for any style of armature sheet now in use, and of any size within the capacity of the press to punch. The one shown has 280 inches of cutting surface, requiring about 350,000 pounds of pressure in punching .040-inch stock. The outlines in the last sketch show some of the shapes punched by the use of compound dies; the pieces No. 1, No. 2 and No. 3 are slit at the same time they are punched, by the use of dies set in the upper stripper, thus saving a second handling of the work. Many blanks now punched in two or more operations could be done in one, and this article is inserted in the hope that it may lead to a more extended use of these dies.

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Hub Forming and Drilling Machine.

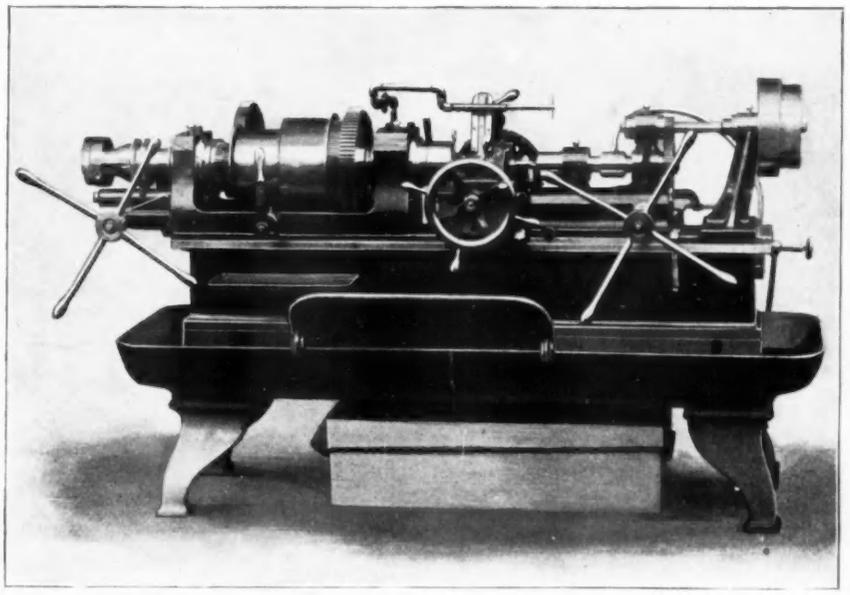
We give herewith an illustration of a hub forming and drilling machine, which represents the latest practice of the Pratt & Whitney Company in this line.

While the forming is being done upon one hub, the preceding one is being drilled and cut off; the drilling mechanism being shown at the right. This is driven at the proper speed for the best results by an independent belt, and is fed automatically or by hand. Forced lubrication is secured by a pump and the flexible tube shown.

The chuck is of the spring collet variety, and is opened and closed the same as the Parkhurst, but instead of the usual lever, a rack and pinion movement, with pilot-wheel, are substituted. The stock is fed through the spindle without stopping the machine.

Two tools are used for forming, both these being circular in form, so that they can be ground without alteration of form. An automatic back-rest supports the work.

The spring collet will take stock up to 2¼ inches diameter; front spindle bearing 7 x 3¾ inches; largest step of cone 11 inches diameter for 6-inch belt.



HUB FORMING MACHINE.

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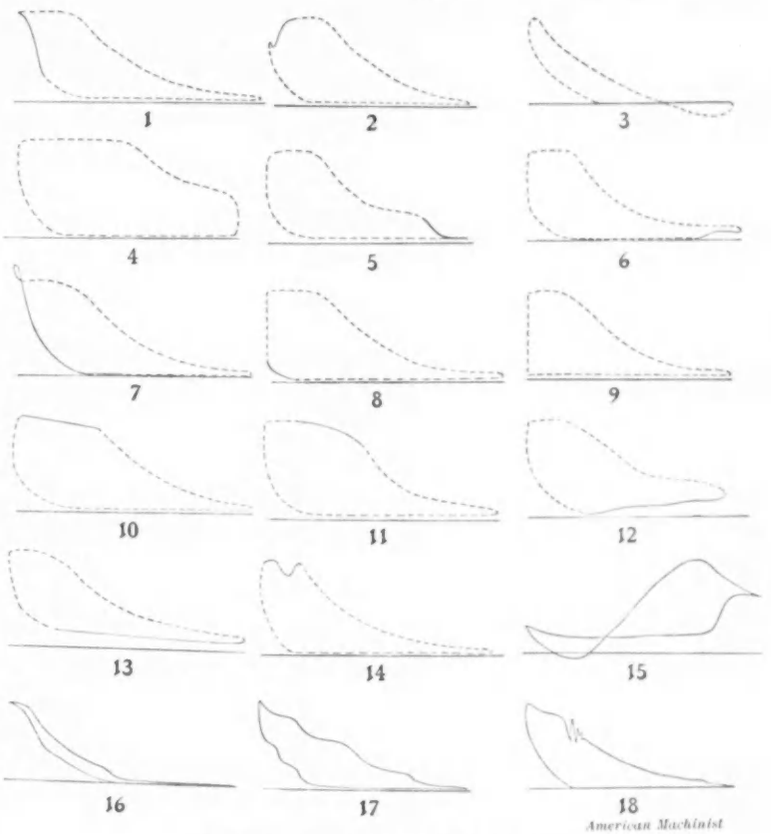
Faulty Indicator Diagrams.

We reproduce from "The Practical Engineer," London, a little cut in which are brought together the faults most frequently shown by indicator diagrams. The cards are mostly assumed to be correctly taken, and the faults are then, of course, engine faults. Only the last two of the cards show faults attributable to the indicator. A full line is given to that part of the card illustrating each specific fault. The faults indicated are as follows:

1. Too early admission.
2. Too late admission.
3. Too early cut-off.
4. Late cut-off.
5. Too early release.
6. Too late release.
7. Too early compression.
8. Too little compression.
9. No compression.
10. Choked admission.
11. Leaky cut-off.
12. Choked exhaust.
13. Excessive back pressure.
14. Double admission
15. Eccentric slipped backward.
16. Eccentric too far ahead.
17. Indicator inertia.
18. Sticking indicator piston.



ERRORS IN INDICATOR CARDS.

Universal Cutter and Reamer Grinder.

The cutter and reamer grinder which we illustrate herewith has some novel features, among which is the fact that both the wheel spindles (one for outside work and the other for inside grinding) are always in position and ready for use.

These two spindles are placed at right angles to each other, and in the engraving the attachment for inside grinding is shown in position with a cutter ready for internal grinding.

A separate belt from the countershaft drives the internal grinding spindle, and to avoid belt pull and consequent disturbance of this spindle, the belt is not applied directly to it, but runs under two grooved pulleys (round quarter twist belt) which are placed one on either side of the spindle and drive it by frictional contact with a small pulley on the spindle. As the spindle pulley is between two wheels which press equally against it from opposite sides, there is no side pull, and a high speed and steady running are easily possible.

The feed of the internal grinding fixture is by the lever shown, and can be at any desired angle for taper work. At the same setting of the work it can be faced by the larger wheel if desired. The internal grinder spindle runs in a bronze sleeve which is adjustable to or from the work, and clamps at any desired position.

The attachment for grinding cutter (cylindrical or angular) is similar in form, but has a knurled collar instead of the pulley, and a pair of centers, one of them with a loose driving pulley, afford facilities for grinding reamers to size and backing them off.

Another head carries a facing chuck, and is adapted for split jaw chucks, two of which accompany the machine.

Work 14 inches long, 4 inches diameter, is taken upon the centers. The machine is made by H. G. Barr & Co., Worcester, Mass.

UNIVERSAL CUTTER AND REAMER GRINDER.

Cast-Iron Bearing Surfaces.

BY C. O. GRIFFIN.

Your recent editorial, entitled "Cast-Iron Prejudice," and the letter signed "G," on "Cast-Iron Lathe Spindles and Crosshead Pins," opens up an old subject which deserves further discussion.

It is interesting to look back and note the progress, which, though sure, is provokingly slow, in substituting cast iron for other materials for bearing surfaces. It is true that there seems, at first sight, to be a counter movement in the opposite direction, though I believe that in those places where the use of cast iron has been discontinued, it has been for some constructive reason, other than that of durability. In the case of lathe spindles I believe cast iron to be the best known material so far as the journal surface is concerned, but unfortunately it is lacking in the qualities needed for the screwed nose. In the case of crosshead pins, the desirability of a removable pin has undoubtedly been the chief reason for discarding the old cast-in pin, though it is by no means certain that, on the whole, the change has been a good one.

We do not have to look back very far to find cast iron ignored in many places where it is now used as a matter of course. Eccentric straps were formerly lined with brass, and, in fact, Unwin's "Elements of Machine Design" calls for that construction to-day, though in American practice it has long been discarded. Slide valves were formerly made of brass, and I believe are so made to-day for English locomotives, but we found long since that cast iron is much better. We are often told that "cast iron is all right where the loads are light and the lubrication ample, but not otherwise," but I want to ask if there are two bearing surfaces to be found more unfavorably situated except as regards the presence of grit, than those two? Eccentrics, of course, are favorably situated as regards lubrication, but otherwise they have a hard time of it. The bearing is short and large; the rubbing speed is high; the load is heavy, and especially the strap is springy, leading to concentration of pressure. Slide valves work under still worse conditions. The load is heavy and the lubrication indifferent, but in both cases cast iron is found by universal experience to be the best material, and, mind you, cast iron on cast iron—none of that "difference of material between the two surfaces" which the ancient text-books tell us is essential.

One of the places where cast iron is eminently suitable, and where it is largely ignored, is to engine cross-head gibbs. Some years ago I had charge of the building of a line of engines, and I found the crosshead gibbs of cast-iron faced with brass. I enlarged the patterns so as to omit the brass, letting the iron shoes run directly on the cast-iron guides, and in no case has any trouble developed, while

the durability was of course largely increased. In this connection I recently received a valuable object lesson. A builder, new in the engine business, had, some years before, built a geared hoisting engine. The crank was placed on a long shaft carrying pinions, to which a row of drums was geared. This engine had a solid cast-iron crosshead without gibbs, running on cast-iron guide bars. With increase of work, it became desirable to put a second engine on the farther end of the pinion shaft, which was done. The second engine was a duplicate of the first, except that the builder thought he would "improve" it where he could, and he inserted brass gibbs in the crosshead. At the time I saw the engines, the first one, with the cast-iron surfaces, had been running about seven years, and the second one with the brass gibbs about two. The brass gibbs were so worn as to be ready for renewal, but the cast-iron had worn so little that the shake was imperceptible. The lesson is obvious.

Most Corliss engine specifications today call for "crosshead gibbs faced with genuine babbitt metal." I have great respect for genuine babbitt in its proper place, but it's out of place here. Cast iron would cost less and give better service.

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A Powerful Press.

We illustrate herewith a press of somewhat unique design, which was first suggested by the requirements of its builders, the Ottumwa Iron Works, Ottumwa, Ia. The press, which weighs 24,000 pounds and has a steel shaft 11½ inches diameter, has its frame made of one casting, in which the shaft is supported by two bearings, one each side of the crank, and is driven by the herring-bone gears, as shown.

The vertical adjustment of the dies, instead of being in the connection between crank and slide, as is usual, is in this case placed below, and is in the form of a wedge, the larger end of which is shown in the engraving. This is placed under the support for the lower die, and is moved transversely by a screw for the vertical adjustment of the lower die.

The large gear wheel is 82 inches in diameter. The press has proven itself to be very powerful, and especially useful for such operations as are sometimes called cold forging, where articles are made either of steel or of some softer metal. It is found, for instance, that tool-steel blocks 1 inch square by ½ inch, and varying in thickness 1-16 inch, can be placed in this machine and, by compression, brought to a uniform thickness within 1-1000 inch.

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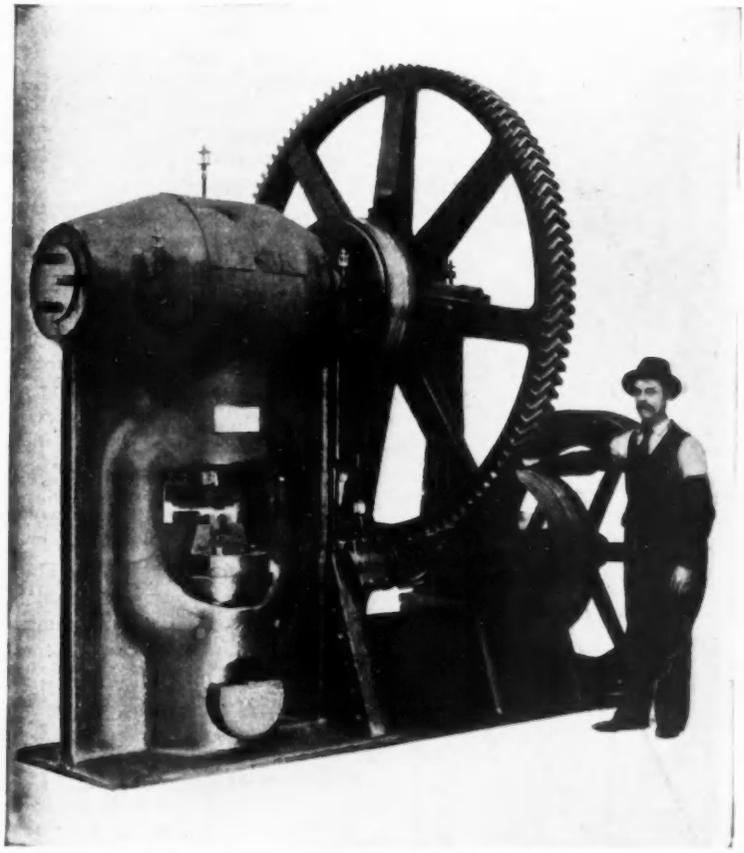
"Electrical Engineering," after its April issue, will be published semi-monthly instead of monthly, as heretofore.

A Gas-Burning Water Heater or Steam Boiler.

The boiler which we illustrate cannot fail to be of interest to many of our readers. We have happened to know, at one time or another, many a young machinist, and some not so young, who have built small steam engines which were entirely ornamental and not at all useful because they had no boiler and no means of getting one. There is also a large and constant demand for small steam boilers for legitimate business, not only for running small steam engines, but for supplying steam for various purposes, and the present device seems to be well adapted for such use.



STAMPING PRESS.

We speak of the apparatus illustrated as a steam boiler, a water tube boiler, too, by the way, so that it is just in fashion, and as a steam boiler it will be of most interest to our readers; but it is primarily a water heater for domestic service. It is, in fact, the regular 30-gallon hot water tank connected with the "waterback" of a range or cooking stove, the circulation through the waterback being by means of the two pipes down at the right hand side of the tank, the colder water leaving the tank by the lower pipe and after passing through the waterback returning, more or less heated, by the upper pipe

The means provided for heating the water by gas are additional to and independent of the waterback heating arrangement. When there is no fire in the range the gas may be used, or if hot water is wanted quickly and in large quantities it may also be employed in connection with the fire. A central chamber *B* extends up to nearly the middle of the boiler, and a pipe from the top of it runs right up through, giving a free passage for the products of combustion of the burning gas. A copper water tube coil *C*,

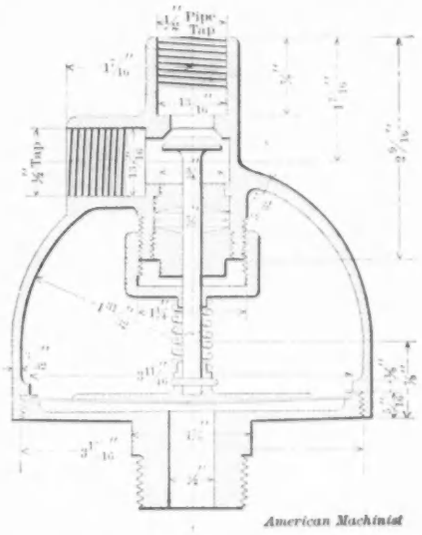


Fig. 1. GAS REGULATING THERMOSTAT.

with an open end at *S*, extends up through the chamber *B*, and a pipe continuation delivers the water usually at *L*. The gas burner is at *D*, with a pilot burner or lighter at *E*. The gas connection is at *H*, the branch *T* going to the pilot burner *E*,

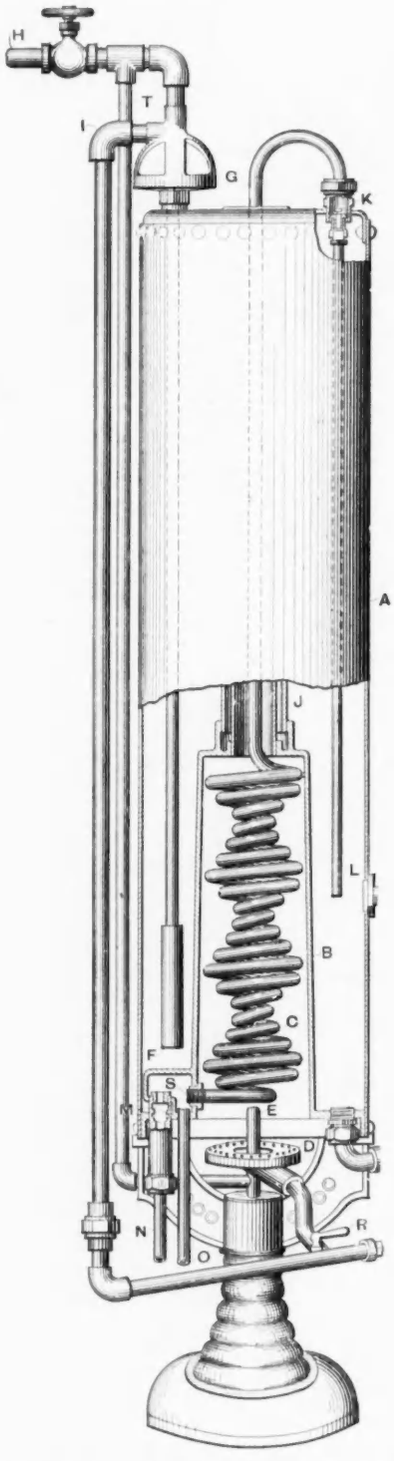


Fig. 2. GAS BURNING WATER HEATER.

while the supply pipe *I* is connected with the thermostat *G* to automatically regulate the burner according to the water temperature. The thermostat will be understood by reference to Fig. 2, in connection with Fig. 1. It consists essentially of a diaphragm which is pressed down by an adjustable spring and pressed upward by the heating and expansion of the air below it, especially the air in the lower and enlarged end of the vertical pipe at *F*, Fig. 1. With the water cold, the valve above the diaphragm is open, and the gas flows freely to the burner; as the water is heated and the air in the enclosed tube expands, the diaphragm is forced upward, and the valve closes, shutting off the gas to the large gas burner *D*, while the pilot burner *E* continues burning and ready to light the large burner again when required. The cold water supply enters the tank by the pipe *N*, and the hot water is drawn off by the pipe *O*. For heating the water in the tank when none is being drawn, the water in the bottom of the tank is free to enter the heating coil at *S*, and emerges at *L*, but when hot water is being drawn, the double-acting valve *K* operates, shutting off the vertical pipe *L*, admitting the water from the top of the boiler at *K*, and the water is drawn *downward* through the heating coil and delivered as hot as possible. When hot water is being drawn, the cut-off valve *M* also comes into operation. This valve, for the time, automatically shuts off the cold water supply from communication with the little chamber where the pipe *S* emerges, and the pipe *O* is practically connected directly with the pipe *S*, but when the drawing ceases, the free circulation in the tank is resumed as before. The pipe *N* is always in communication at the bottom of the tank, with the main body of water, whether the hot water is being drawn or not. The valve *M* embraces also a safety valve, or relief valve, so that the pressure in the tank can never exceed the pressure in the mains. The gas burner is a large one, and heats the water very rapidly. It is capable of burning as high as 40 cubic feet of gas per hour. This is not necessarily wasteful, as it only burns as long or as fully as may be required for heating the water.

For a steam boiler none of the automatic appliances described above would be required. The central coil would generate the steam; some means of feeding would be required if the water-main pressure was insufficient. A water gage could be placed on the side with its lower end at about the letter *A*; then with a safety valve and proper pipe connections the boiler would be complete. We understand it is the purpose of the inventor, Mr. John S. Coe, Paterson, N. J., to prepare steam boilers in this style.

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The reports of the English trade unions show continued improvement in the engineering trades of Great Britain. The last report shows less than two per cent. of the membership for the entire country to be out of work from all causes. The same is scarcely true of our own country. Why is this thus?

Letters from Practical Men.

Foreign Workmanship—French Clocks.

Editor American Machinist:

When I hear or read of the superfine workmanship of foreign machines, I am reminded of my own experience with a French clock. It is my misfortune that my "better half" is the owner of one of these perfect pieces of mechanism, given her as a wedding present twelve years ago. I have never kept tally on the number of times it has been to the tinker's, but its longest run—the present one—is eighteen months, and I had to take it to a New York man, a specialist in French clocks—who charged me five dollars for knowing how—to get it to run that long. It has been to many out-of-town watch tinkers, but to no purpose, or at any rate no purpose beyond a few months. I long ago gave up trying to keep the striking gear in running order, being satisfied if the hands would keep going.

All the same I am bound to own that when it does go it keeps time like a chronometer, and I have no doubt that if it could be set up on a masonry pier in an astronomical observatory, covered with a glass case, and only looked at from a distance through a telescope—and not too often at that—it would probably discount most of the observatory "regulators"; but the fact remains that as a household timepiece it is a dismal and expensive failure. In workmanship it is, of course, a gem, but it does not go. In other words, while it is a beautiful piece of mechanism, it is a mighty poor clock. A Yankee clock costing one-fifth of what this did would be far more satisfactory, and save a heavy strain on my temper and pocketbook. Moreover, my experience is not exceptional, but the regular thing. A friend of mine has three of these things—bought by an enthusiastic wife—but he is too poor to keep more than one of them going at a time. Still, they fulfill the purpose for which they were bought—that of mantel ornaments.

Now, I sometimes wonder if these superfine French machines of which we sometimes read, are not, after all, like French clocks—splendid pieces of workmanship, artistic, and all that, but lacking the "get there" principle.

C. O. GRIFFIN.

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Twist Drills and Flat Drills.

Editor American Machinist:

Whenever the subject of drills comes up, somehow, unconsciously, I always seem to lean toward the obsolete. Some of your readers will, no doubt, ridicule the thought that anyone should advocate the usefulness of the flat drill for any purpose. My respect for it is solely within its own field, if it may be allowed one—a territory now, perhaps, wholly

covered by its rival, the twist drill; but I hold that neither has the right to hold sway as king of all. Most jobbing men will know what I am talking about, and they are mostly sharp enough to have a few old flats lying around handy for certain jobs which might and do turn up once in a while. For instance, it might be necessary sometime to drill a few hundred 1-inch holes in some tool-steel blocks. Yes; twist drills are hard enough, but they don't seem to drill. The flat drill cuts better—but still you undoubtedly hear complaints that the larger twist drills are too thick on the points. The center of the drill has neither a chance to punch nor speed enough to cut well. A drill press makes an awfully poor punch press, anyway. For my purposes, I have always been foolish enough to drill out the centers of large holes with a small drill running at the proper speed. By doing so I seem to accomplish several results. The big drill will follow the small hole sure, and the small hole is less liable to run, thus insuring greater accuracy of location. A large drill with point relieved progresses double as fast with less strain on the press. Still, in view of these happy results men will call for weak, thin-pointed drills, and just as often shiver them from stem to stern, forgetting always the tremendous distortion forces that are forever attendant at the point of all working drills. Give the twist drill a show, and it is monarch of its territory; but at the same time don't lose sight of the grand old flat—it has a habit of bobbing up once in a while on a particularly good hard job and making its fancy neighbor wonder where it is at. I expect I am stirring up disputed premises, and I may bump up against somebody, which is not my desire. However, Mr. Editor, when anyone gets to jumping up and down on old flat lips in general, I am bound to take the floor with a view of offering a few explanations.

L. C. SHARP.

Omaha, Neb.

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Those Foreign Keys.

Editor American Machinist:

In your issue of March 4th are illustrated two efforts to supersede the common rectangular key for uniting, as it were, a shaft and a hub. It is a curious but by no means a remarkable fact that this oldest form of key has never been successfully superseded, and that there is no evidence that it is likely to be. The fact that this old-time key offers no special inducement to the hub to split, is tried to be got around in every conceivable and inconceivable way, but never with any measure of success. Its bite in hub and shaft is a square bite, with no intention to do much of anything other than *drive*, which is a very good thing. It is quite unnecessary to enter into any argument to show that this is so. A comparison of this old and still much present type of key with either of the English keys you show will make this plain enough. By splitting the hub I do not mean splitting it by driving the key. Doing that would be an unwarrantable thing to do with any kind of key. I mean splitting the hub through the effort of the key to do its legitimate work.

Either of the keys in March 4th issue is not comparable in its intention to rend a hub with that other English key shown in your issue of February 4th; the round pin on the very slightly inclined surface. That appears to be a most excellent device for the purpose last named.

The key shown in Fig. 2 (March 4th) may be new to most readers of "Engineering." In some parts of this country it is older than many of your oldest readers, but in all these years has, for rather obvious reasons, never found favor of consequence. It has always been looked upon as rather a freak of the imagination —something that, under exceptionable conditions, is likely to work no particular harm.

Fig. 1 has hardly so much in its favor in an intention to split the hub as Fig. 2, but it has more than enough for most purposes.

F. G.

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Some Records of Drill Testing.

Editor American Machinist:

The articles in your issues of December 17th and 31st, concerning twist drills, proved very interesting to me, and recall some experiments I had to do with a few years ago, while in charge of the mechanical department of one of the large twist drill and tool works. Complaints came in from some of the large agricultural shops that our drills were not giving satisfaction, and investigation showed that the trouble was between the sizes of ¼ inch and ⅜ inch. Some drills were taken and tried in an ordinary manner, and were thought to be pretty fair drills. Several days after this the manager came in with a dozen $\frac{5}{16}$ jobbers, made by another concern, and wanted them tested in the severest manner possible with our equipment. The only suitable tool was an ordinary drill press, that ran 254 revolutions per minute, with a feed of .018 inch per revolution, making each lip cut a chip .009 inch thick. This I considered a test out of all proportion to the drill. But as to what the correct cutting speed and feed of a drill of this size is, this article has nothing to do with; I am simply going to state some facts regarding what some drills did at the above rate of speed and cut.

We used a good grade of soft steel, 1 inch thick, to try the drills in, and provided a means of flooding the drill with a good quality of No. 1 lard oil. We drilled with these drills until it was thought that they could not possibly go another hole, and it was found that the greatest number of holes done by one drill was fifteen, and the smallest number twelve. This was considered a very good "batch" of drills, the poorest thus drilling 12 inches with one grinding and at the rate of 4 inches per minute.

One dozen of our drills of the same size were then taken from the regular stock and tried under the same conditions, and the result was anything but encouraging. One out of the dozen drilled twelve holes without breaking; the others broke somewhere between the fourth and the twelfth holes. Some more drills of the same stock were drawn up to a little higher temperature (that is, a little softer), with only slightly better results.

A close inspection of the drills that had done so well, convinced us that they were made of wire—that is, they were cut off a drawn-wire drill rod—while our stock of this size was turned. Then, in order to find out if there was any difference between these two kinds of stock, we took six wire and six turned drills, and hardened them, all being heated as uniformly as possible. Six bundles were made of them, by tying a wire and a turned drill together, and they were placed in the oil for drawing. At the lowest figure on the thermometer thought safe, the first bundle was taken out and the thermometer reading noted; at five degrees higher the next bundle, and so on until all were out. They were then tested, and the number of holes drilled by each, with the condition of point, noted. The wire drills in every bundle proved superior to the turned ones. The best drill, doing sixteen holes, was then thought to be all right, and six more were cut off, using one bar for the six, hardened and drawn to the same temperature as had been noted for this drill.

We tried hardening by "baths" and "mufflers"; used different cooling mixtures, different oils for drawing the temper, several kinds of thermometers—even one "made in Germany." During this time there had been some experiments also on the mechanical operations in making the drills. They were milled with a spiral whose angle ranged from 12 to 25 degrees, and with "lips" hooked and curved back. The angle of the points was changed up to 5 degrees each side of the standard. More and less clearance was given the points and sides, and, in fact, every operation on the drill was studied with a view to improve it; but still the drills were only very little better than at first. Several expert temperers added their store of knowledge(?) to that already on hand, and the difference in their opinions and methods was something amusing; one, however, very materially lessened the cost of tempering.

The "testing" had been carried on for about a year, almost every day, and the working properties of the drills were not enough better to be worth speaking about. It was then decided to try another kind of steel, as up to this time nearly all had

been "Stubbs." We got steel from several well-known manufacturers, made up some drills, and tested them. One of these brands showed up remarkably well from the start, and at the third test, twelve $\frac{5}{16}$-inch jobbers drilled eighteen holes each, which was the best test made up to this time, and considered good enough. During the period of this testing, we very often got drills of other manufacturers, both forged and milled, and always found the milled drills to stand the test better than the forged ones. This seems to be contrary to what is generally said of these two classes of drills; but, from the results of the tests (under the above conditions), I would choose milled drills, at least for this class of drilling.

The testing has been carried on at different periods in the last two years, and I have been informed that they now "do better than eighteen holes."

BUCKEYE.

[Drilling $\frac{5}{16}$-inch holes in steel at the rate of 4 inches per minute, or worse yet, 4.57 inches per minute, according to the data given, would seem to be quite a severe test anywhere. It certainly would make it possible to test many drills in little time.—Ed.]

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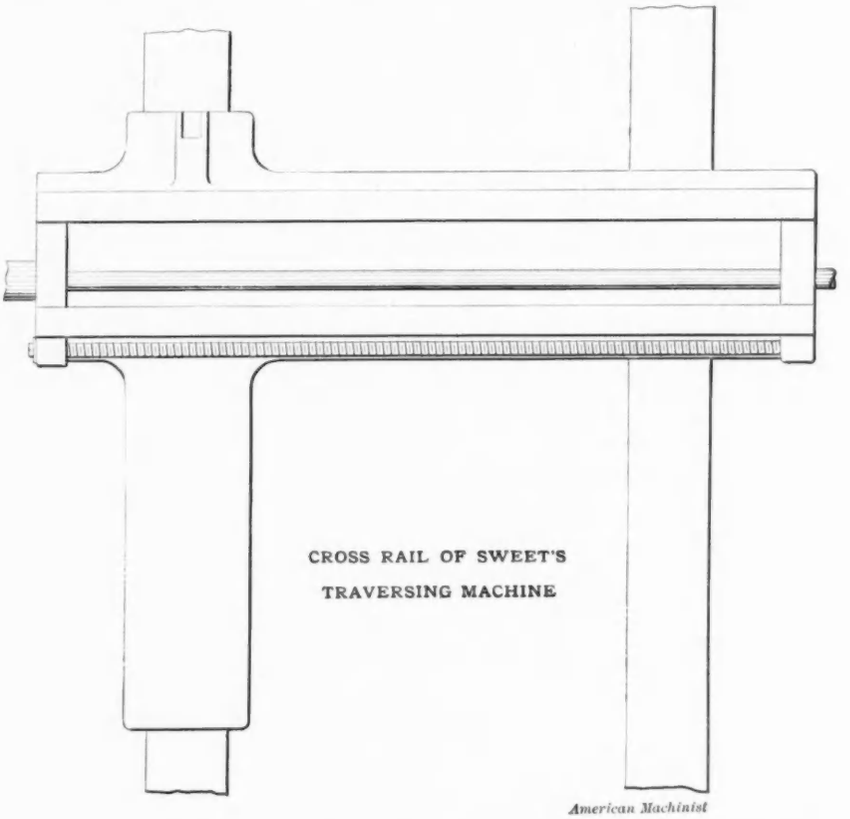
Planer Elevating Screws.

Editor American Machinist:

The accuracy of a pair of planer elevating screws does not, for practical use, depend upon their being of any particular pitch, or even, within limits, of their being of uniform pitch throughout their length. It is dependent, though, upon their being mates, and upon any inaccuracy of pitch in one being duplicated at the same place in the other. Probably no one will dispute that, with perfect screws, the right and left plan is as good, and no better, than making both of the same hand. Perfect screws have not been made yet—they are very hard to make. Generally in mechanical operations, whenever an error can be detected and measured, it can also be corrected; but probably there is not in the whole range of mechanics another piece of work in which the errors can be detected so readily, and are eliminated with so much difficulty, as a screw. Still, it is possible to make right and left hand screws good enough to meet usual requirements, and this the Gray Planer Company do, as Mr. Willis has stated in your issue of February 11th. All that Mr. Willis wrote regarding the high quality of their work I most heartily indorse; still, I believe if they would expend one-half the pains on making right-hand screws that they now devote to the right-and-left plan, they would get better results, at much less cost.

That they now obtain satisfactory accuracy, is conclusive evidence (which is not needed) of their care and skill. It would also show much painstaking skill to read the "American Machinist" backwards every other week; but as there would be no possible improvement in results, it is doubtful if Mr. Willis would commend the scheme, even to divide the wear on the mental lead-screw. Of course, in cutting right-hand screws, the wear comes on but one side of the thread of the lead-screw, changing to the other side when cutting left hand. Because the elevating screws are made in pairs, Mr. Willis assumes that "the wear upon the two sides of the lead-screw is as absolutely uniform as anything can well be." There is a mistake here, providing the screws are cut in a lathe in the usual way, for the wear will then tend to make the pitch of the left-hand screws longer and that of the right-hand ones shorter, for the lower part of their length, while just at the top the reverse is true. If both the right and left screws are put in the lathe in the same way, then the nut will travel over about the same part of the lead-screw in cutting both; but while for different-sized screws the place where the top end of the thread comes will not vary much in its position in the lathe, the lower end will be of various lengths. Therefore, there will be a place on the lead-screw where both sides of the thread are worn every time a pair of screws are cut, whether long or short; while down towards the tail-stock will be a place which is not worn at all, the wear between being graduated according to the various lengths and quantities of screws cut. If both sides of a thread are worn at one point, and not at another point, it is plain that the pitch of one side of the thread is lengthened and that of the other side shortened by this wear. Of course, when it gets too bad, a new lead-screw may be put in; but if the guaranteed limit of error is $\frac{1}{1000}$ inch on the long screws, the lead-screw must be changed just before the part of the thread which wears most has worn $\frac{1}{2000}$ inch. As this amount of wear, or ten times as much, would have no injurious effect on elevating screws of the same hand, it is hard to see where the claimed advantage of dividing the wear comes in—it looks much like a mistake. Professor Sweet suggested that if this advantage is so important, it might be obtained and the disadvantages avoided, by building half the planers with right and half with left hand screws.



CROSS RAIL OF SWEET'S TRAVERSING MACHINE

American Machinist

Another element of inaccuracy, which is more serious with a lead screw of coarse thread than with one of fine pitch, is the torsion of the lead screw, which tends to lengthen the pitch of the right-hand elevating screws and shorten that of the left-hand ones. Another trouble is the torsion of the work being cut, tending to shorten the pitch of right-hand and lengthen that of left-hand screws. As the only objection to the right and left screws is their cost, it would seem that Mr. Willis, in showing the possibility of making them accurate within commercial limits, has failed to show how this objection "falls to the ground." Mr. Willis says that the matching of two screws, right and left, is a very severe test. This is a mistake—one which it cost a member of the Gray Planer

Company a box of cigars to learn (the cigars hereby acknowledged). As a matter of fact, right and left screws may be readily matched as stated, even when of quite different pitches, and a casual examination might not detect anything wrong; but if not alike in pitch they will not lie exactly parallel to each other, and when forced into a parallel position they will be sprung out of true, the shorter one becoming convex and the longer one concave on the sides in contact.

Planer screws are very liable to injury. It is surprising how easy it is to permanently change their pitch by a strain. It would seem an improvement to make them larger in diameter. A number of advantages could be gained by doing away with the elevating screws altogether; they are hardly an up-to-date device for securing parallelism of the cross-rail. The open-side planers and several types of large milling machines do better by having a long sliding fit of the cross-rail on one of the housings. As an example, the cut shows the general scheme of the rail in Professor Sweet's traversing machine. It has been shown in these columns before, but will bear repetition. The long bearing gives a guide to be depended upon. The whole rail is counterweighted, and is raised and lowered by rack and pinion. The crank for this is at the end of cross-rail, and the rail is run up and down as easily, quickly and conveniently as the carriage of a 36-inch lathe is moved along its way. A hand-wheel—also at the end of rail—locks or unlocks both ends of the rail with a single motion. The operator does not walk around the machine to unscrew and screw up bolts when he wants to move the rail; nor does he need to try the surface gage under it to see whether it moves alike at each end. Probably for very large machines the plan is impracticable, but for medium and small sizes it certainly has numerous advantages.

E. J. ARMSTRONG.

Oswego, N. Y.

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Right-Hand and Left-Hand Planer Elevating Screws.

Editor American Machinist:

As the screws for elevating the cross-rail upon the planer have had a little attention in the columns of the "American Machinist" lately, I may perhaps be permitted to offer a suggestion. I confess that I like to see the right and left screws used, and I see no difficulty in producing them as nearly correct and reliable as both right-hand can be. There is a slight advantage in using the right and left screws, besides the looks of them, and that is, that both the bevel gears on the hand crank shaft will be on the inside, and the shaft will be more equally supported against springing than where one is outside and one inside; so the mechanical instinct that dictated the right and left screws would seem to have been correct.

The keeping of a special lathe and a special lead-screw for cutting nothing but elevating screws, either right or left, shows careful and correct practice. If there is work enough in the shop to keep one lathe running all the time, or most of the time, on such screws, it shows good business, too. In cutting a lot of screws, either right-hand or left-hand, the wear upon the lead-screw would presumably be equal for the whole length of the screw cut, so that there would be no change of lead. The only chance of any trouble would seem to be in the fact that the screws cut are not all of the same length, and there would be more wear upon the lead-screw where the shorter ones were cut.

In cutting right and left screws in the old way—that is, starting the tool at the tail-stock end for the right-hand screw, and starting near the head-stock and cutting the other way for the left-hand screw—there would be likely to be more trouble from the torsion of the screw while being cut than from the wear of the lead-screw. The twisting of the screw under the strain of the cutting tool would tend to make the pitch of the right-hand screw somewhat finer, and the pitch of the left-hand screw somewhat coarser than the absolute standard, and the difference in the two screws from this cause might easily be more than from any possible wear of the lead-screw. This error would be the worst at the ends of the screws, diminishing gradually toward the other end, and with the general run of planer work the cross-rail is more frequently used pretty well down rather than very high, so that the error would be constantly asserting itself.

But, after all, we can have our right and left screws just as we have been brought up to have them, and we can have them certainly just as correct as either all right-hand or all left-hand screws can be. We can fix it so that the use of both screws right-hand will be just an advertising dodge to capture those who are not well informed, and will carry with it no presumption of greater precision.

All we have to do is to cut both the right-hand screw and the left-hand screw from the tail-stock end, running backwards, of course, and using the tool at the back side of the screw when cutting left-hand. The errors due to the wear of the lead-screw could not then be possibly discoverable if the screws were cut in pairs, or alternately right and left. The error due to torsion in cutting would also be all one way, instead of being one opposed to the other, as under the old-fashioned way of cutting left-hand threads. It is possible that in some cases it would be necessary to reconstruct the rest so as to run the tool-post back far enough, but that is the only trouble that would be likely to arise.

TECUMSEH SWIFT.

Reciprocating Parts of High-Speed Engines.

Editor American Machinist:

Under this heading, Mr. C. O. Griffin, in the issue of January 21, 1897, says: "In point of fact, the adjustment should be such that the reciprocating parts will absorb *at least all* the steam pressure at the beginning of the stroke." In the copy of February 11, 1897, Mr. Charles T. Porter writes: "There can be no question about the soundness of the position taken by Mr. C. O. Griffin. . . . ."

These statements of the two gentlemen show that their opinions about this point differ from what is generally conceded by engineers to be correct. Allow me to explain this with the aid of diagrams: In Fig. 1, *A* and *B* represent the cards of a high-speed engine. In Fig. 2, *C D* represents the actual pressures on one side of the piston, obtained in the usual way by subtracting the distances from the atmospheric line to the exhaust compression line of card *B*, from the ordinates of *A*, *X Y* being the neutral axis.

In Fig. 2, let *E F* be the curve of pressures necessary to accelerate the reciprocating parts during the first part of the stroke, and to retard them during the second half, under the supposition that

$$\frac{\text{Length of connecting rod}}{\text{Radius of crank}} = \infty$$

Then *G H* will be the actual pressures, *including* those absorbed and generated by the inertia of reciprocating parts. We see that from the beginning of the stroke up to *I*, the piston, etc., is dragged by the fly-wheel; at *I* the piston overtakes the crank pin (reversing the slack) at a certain distance from the dead center, at a greater or lesser piston speed. This always occurs if the inertia of reciprocating parts absorbs *more* than the initial steam pressure, and sometimes if this inertia absorbs only *all* or a part of the steam-pressure; namely, if, at high expansion, the hook at *Z* (Fig. 3) surpasses the neutral axis *X Y* so that we obtain a change of pressure-direction (reversing the slack) three times (at *G I* and *I*) during a single stroke.

Both conditions are to be avoided under all circumstances, being the cause of pounding in some cases, and of destruction of the entire engine in others. It follows that the term "*at least all*," used by Mr. C. O. Griffin, is entirely incorrect.

As the inertia increases in accordance with the weight of reciprocating parts, the safe speed of an engine is a function of this weight, the initial steam pressure, and the point of cut-off. The higher the pressure, the higher the speed; the greater the weight, the lower the same.

Just the contrary, said Mr. Charles T. Porter, when demanding a heavy piston for a high-speed engine. The relation between the steam-pressure, the inertia of the reciprocating parts and the speed of an engine are masterly and fully shown by Joh. Radinger in his book, "Dampfma-

schinen mit hoher Kolbengeschwindigkeit," edited in 1870, so that Mr. Charles T. Porter's statement, "A radical change in the steam engine, already effected, renders this great object not only attainable, but that in a degree exceeding the wildest dreams that could be dreamed even ten years ago," can hardly be approved. Radinger, twenty-seven years ago, wrote: "As the influence exercised by the inertia in an engine is known, we will utilize it to make the pressure on the crank uniform, and set from the beginning the limit which should never be surpassed by the speed of reciprocating parts. Then we are enabled to approach this limit totally or to a certain degree. . . . Often we find the possibility of a still further increase of piston speed, and therewith a still greater perfection of the powerful-grandest of human works—the Steam-Engine."

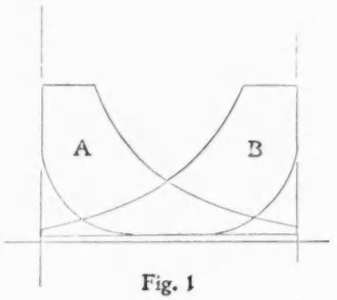

Fig. 1

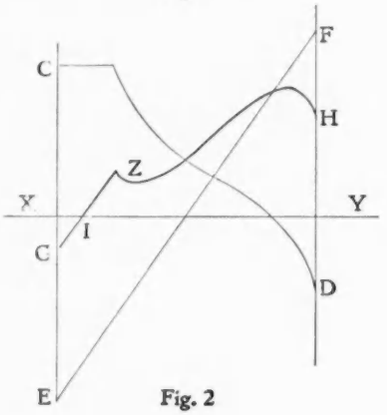

Fig. 2

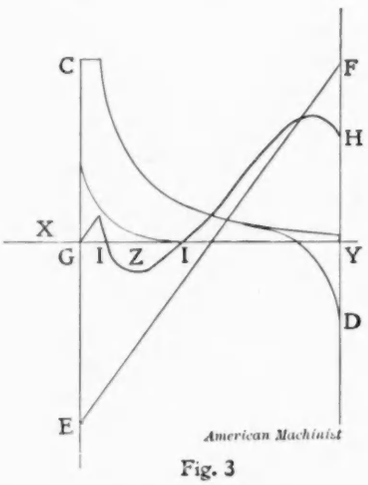

Fig. 3

RECIPROCATING PARTS OF HIGH-SPEED ENGINES.

WALTER RACHALS.

Youngstown, O.

▲ ▲ ▲

Chattering Reamers.

Editor American Machinist:

The pointers on reamers, etc., by Mr. Almond and Mr. Frank Richards, certainly can be counted amongst the innovations in that class of tools, but their methods of producing a satisfactory cutting edge, by removing the principal element in the tool, cannot meet with much favor.

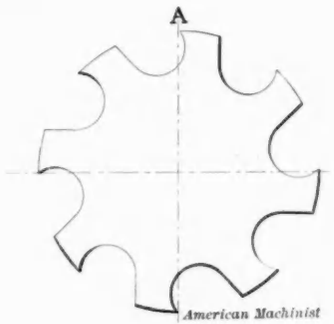

Fig. 1

SECTION OF REAMER.

The reamer bears the same relation to its work as any other finishing tool, whether it be inside or outside; for if we attempt to finish a hole with a boring tool whose upper face is flat or radial, we can expect only one result, as with a reamer, that requires the edge removed before using.

The reamer has undergone many changes for the purpose of avoiding chattering; irregular spaces being one (certainly to no purpose); an odd number of flutes, quite equal as to any advantage; and lastly (though an old idea) comes the spiral-fluted reamer. I can see no reason for adopting a form of tool like the latter, while there is an easier way out of the trouble, as the difficulty in sharpening the spiral-fluted reamer alone condemns it.

Fig. 1 is an end view of a reamer that will not chatter, whether parallel or taper, and at the same time it cuts freely and retains its edges remarkably well. The secret lies in the form of tooth, which has no equal, so far as I know.

The cutting face, as at *A*, unlike the ordinary reamer (which is invariably radial), acts in the same manner as the finishing tool for either boring, turning or planing, and as in all three cases the amount of clearance required is so slight as to leave no tendency to chatter, a smooth hole is the result. Another good feature in this form of reamer is the ease in sharpening by grinding the cutting faces and still holding well to size.

Fig. 2 is a tool for the same purpose as the one Mr. Richards was about to cast aside as useless, when Mr. Richardson appeared and helped him out by removing the cutting edge with an oilstone, after which a good job was done. Had the tool been made as shown here, Mr. Richardson's assistance would not have been necessary.

Perhaps no simpler or better illustration can be had to bear out my conclusions on the chattering question than the ordinary flat drill; for, let us undertake to countersink a hole with one, and we produce a corrugated surface, as with the factory-made reamer. Then let us grind the surface of one of the angles round, leaving only one side to cut, and the chattering is partly removed; but the surface is not yet satisfactory. And now comes the question of remedy, which certainly is not to remove its cutting edge, but to give it more edge in the form of lip, and less clearance; and you can't beat it.

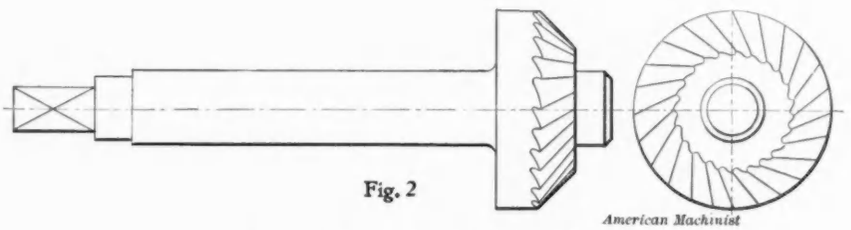

Fig. 2

A NON-CHATTERING REAMER.

JOS. A. ROTHWELL.

Brooklyn, N. Y.

▲ ▲ ▲

Balanced Lathe Dog—Patented.

Editor American Machinist:

In No. 5 of your esteemed journal, page 96-28, you bring an illustration and description of a balanced lathe driver as a "suggestion" to your readers. In order to meet any misapprehensions on the part of the latter, I beg to state, as the inventor and patentee of the said device, that the same, which, by the way, goes under the name "The Climax," is patented in the United States, and also in Germany.

BERNARD ESMARCH.

Berlin S. W., Zimmerstrasse 87.

▲ ▲ ▲

The Mathematician vs. the Constructor as a Student.

Editor American Machinist:

On page 162 of your issue of February 25th, the book reviewer closes an appreciative view of a practical text-book with

the words: "We take this extract from the preface as an indication of what may be expected as the spirit in which the new mechanical engineering department of (mentioning the university in which this book is used) is to be conducted."

This sentence comes at the end of certain commendatory references to the practical information which is to be sought in a technical school by those who, having previous experience in shop or power house, seek to find at such a school a sound basis of theory on which such practice is founded. This implies therefore, that you would favor the conduct of a mechanical engineering course which should have a basis in the principles of physics, chemistry, mechanics and mathematics, such as cover what we generally know as applied science, for the needs of such engineering students.

Now there are certain grave difficulties to be met. The education of mechanical engineers in America is the heir of precedents and wise decisions of our honored past, as evidenced in the instruction given in early years to military and artillery engineers at West Point and Annapolis, and to civil engineers at Troy. This tendency has been reinforced by the example of the continental schools of Europe which have received in the main a complexion favorable to military engineering by virtue of their governmental relations. From these conditions and from the comparative novelty of mechanical engineering as a profession, it has seemed to me that there has come about a tendency in the educational field to make proficiency in *mathematics* the criterion of capacity for professional engineering work to the prejudice of other sciences which belong not less to the education of the true engineer. It has been made a condition of success in all the better American schools that the students shall pass the examinations in the analytical branches of mathematics before being allowed to take up the real engineering study of their course, and the conditions for adequate preparation bring this exacting and discriminating examination at the end of the second year of a four years' course. It seems to be held that ability to pass the examination in calculus at this time, forms a satisfactory as well as an easy method of separating the persons who are to progress to an engineering or technical degree, from those who are to be discouraged and either thrown out, or compelled to repeat such mathematical years.

I do not wish for one moment to be accused of undervaluing the disciplinary value of the higher mathematics, nor its usefulness as a means of training for exact thinking, and all that this means for the concentration of mind upon a subject until it is mastered. But, on the other hand, I want to call attention to the fact that this policy, or method, or principle, passes through the meshes of the sieve which this critical examination period offers, those who are endowed with a mathematical bent of mind, but frustrates the ambitions of the many good men of force and ability in other lines for whom the mathematical test is really an unkind and fallacious one. If a mechanical engineer in his best sense is a constructor, capable of making things either with his own hands or with those of someone else, or it, in the second place, he represents a type of man who makes things "go," either his own things or someone else's, it may well happen that the possession of these endowments for a high grade engineer may co-exist with meager endowment on the mathematical side.

This may be otherwise stated by saying that many persons would not choose the mental qualifications of the mathematician for the duties which the mechanical engineer is called on to fulfill, and that our technical education, by reason of its precedents and methods, has been discriminating for years against those engineers who were not mathematicians. Nay, I am willing to go even further and to say that it may well be considered one reason why so many employers have been dissatisfied with the so-called "best men" which have been turned out by the technical schools, because the material which was furnished to them were the mathematical experts in the class, while another kind of man would have suited them better.

In other words, there are other departments of science which are fully as important and vital both in themselves and as a means of discipline to the mechanical engineer as that of which the calculus is a representative. For many departments of mechanical engineering there are other branches of science which are much more important.

If the foregoing contention is sound, it ought to mean that there should be found some other way of separating engineering sheep from the goats who are out of their place in an engineering school, than to use the easy process of an examination in analytical mathematics.

I have some ideas of my own on this subject that in a school which has a shop department, the constructors and instinctive mechanics ought to be recognizable by their aptitude for this work. I think that the course in the shop should be calculated and aimed to develop the capacity of a man for thinking along practical lines, and should make him cope with conditions which shall develop his resources within himself so that by some means or other signal ability along these lines may be offset against a less endowment on the mathematical side. The physical and chemical laboratory should offer something of the same sort of opportunity for judging of men upon this side of their nature. The ordinary class-room does not offer such chances.

It will gratify me very much if, through the columns of your journal, this subject may be taken up and discussed, and, particularly, if suggestions can be offered for embodying this idea in a practical shape in shop and laboratory courses, and I shall much appreciate the interest of contributors to your columns, who may feel inclined to give their attention to the question which I raise.

F. R. HUTTON.

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Kilowatt or Horse-Power?

When computing the horse-power of a steam engine and you have multiplied together the piston area, the mean-effective pressure, the double-stroke, the revolutions per minute and all that, if you divide by 44,236 instead of by 33,000 you will have your power in kilowatts instead of in horse-powers. A kilowatt is a thousand watts; a watt is equal to 10^7 ergs per second, or the same number of c. g. s. units of electrical activity; or it is the rate of working in a circuit when the E. M. F. is one volt and the current is one ampere. One horse-power is equal to 746 watts. If kilowatts must be had, and some people want them, it may save labor to get the horse-power in the old-fashioned way and then multiply by .746. Having the power in kilowatts, multiplying by 1.34, or more accurately by 1.3404825 +, gives the horse-power.

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Cotton Mills in the South.

The planning and building of cotton mills in the Southern States continues active. The John P. King Manufacturing Company, of Augusta, Ga., now operating 40,000 spindles and 1,200 looms, are to erect a new mill with 20,000 spindles and complementary machinery. The Georgia Western Cotton Mills are to build a 15,000-spindle mill at Douglasville. The Indian Head Cotton Mills, of Cordova, Ala., are contemplating the erection of a 30,000-spindle plant. The Savannah Cotton Mills are considering extensive improvements.

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"One of the curiosities of American silver money is the large number of coins of that metal which are in circulation that, although counterfeit, are worth more as silver than those issued by the Government mint. These so-called base coins are not only heavier, but are composed of finer silver than genuine specimens."—"English Mechanic and World of Science." [It is surprising how one must go away from home to learn the news.—Ed.]

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A gas tank exploded at the factory of the Liberty Bicycle Works, Rockaway, N. J., on the 12th inst., and resulted in the destruction by fire of three buildings, and damage of two others. Three men were seriously injured. There is some doubt as to the reconstruction of the buildings.

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Mathematics in Engineering Schools.

We publish on another page, a highly suggestive letter from Professor Hutton, which opens up a subject which all must regard as important, and from a source which is highly significant. For many years mechanical men have been urging increased recognition of the constructive side of engineering in the engineering schools, and now that it has been so recognized in one of them, we trust our columns may be the medium for the discussion of the subject, as asked for in the letter referred to, and we hope also that its author may eventually favor us with a statement of his plans in greater detail.

Our own sympathy with the shop man's claims to recognition are well known, though we must own that we have looked upon shop knowledge as something to be placed alongside of and as a supplement to training on existing lines, rather than as a substitute for it. Mechanical and mathematical aptitude seem to us so closely related as to be almost necessarily present in the same individual, and whenever we find a mechanic who disclaims a natural liking for mathematical studies, we are disposed to lay the fact to unfortunate and incapable early teaching, which failed to bring out the beauties of the study, but dwelt instead upon its bare and not very attractive skeleton.

Moreover, we have come to regard analytical mechanics as being, next to the mechanical instinct, the most important foundation stone of an engineer's equipment, and unless this subject is slighted, it is not easy to see how the mathematical work can be curtailed, except by omitting work which is of no value as a preliminary study, such as spherical trigonometry and analytical geometry of three dimensions, neither of which, beyond the rudiments of the latter, have any proper place in any course in mechanical engineering.

This subject of analytical mechanics seems to us of even greater importance to the mechanical than to the civil engineer, by reason of the greater complexity and obscurity of action of dynamic forces over static ones, the former being the ones with which the mechanical engineer must largely deal, while the latter are the ones to which the work of the civil engineer is chiefly confined.

Nevertheless, it is an obvious fact that a very large proportion of mechanical work of the very highest order is done by those who have little knowledge—or, at any rate, little formal knowledge—of this subject, and if the educational needs of such men can be met with a liberal curtailment of mathematical work, we shall endeavor to be the first to give the fact recognition and publicity.

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Legislation on the Metric System.

In a recent number of "Engineering," of London, its American correspondent stated that the American Society of Mechanical Engineers, ten years ago, put itself on record as opposed to the metric system by a vote of 40 to 1. We have looked up the records in this case, and find that at the Hartford meeting in 1881 the society adopted, by a vote of 111 to 24 (ratio of 4½ to 1), a resolution of which the following is the significant portion: "Resolved, That the society deprecate any legislation tending to make obligatory the introduction of the metric system of measurement into our industrial establishments."

This, we think, is quite different from placing itself "on record as opposed to the metric system"; it simply opposes the compulsory use of the metric system.

As we have before stated, we do not wish to be understood as advocating the immediate and general adoption of the metric system. We think it will be adopted, if at all, in this country by individual steps; that is to say, that any given shop will from time to time use metric measurements in specific cases where it seems at the time economical and otherwise advantageous to do so, and that the trend of events may be in the future such as to finally lead to its general adoption. We do not think its use could be or ought to be forced upon industrial establishments; but our humble opinion is that those who oppose the adoption of the system not so much because it would be inexpedient, as because they think it is a system intrinsically inferior to ours, are opposing it from the weakest standpoint of defence, because we think it can be demonstrated that it is in many respects intrinsically superior to our lack of system.

Mr. Coleman Sellers, years ago, in a paper read before the American Society of Mechanical Engineers, presented the case against the adoption of the system in as strong light as we think it can be presented, and we feel bound to say that many of his arguments and conclusions then presented are being shown to be inconclusive by the subsequent experience of shops in which the system is in use. For instance, we recently visited the shop of the M. C. Bullock Company, in Chicago, whose superintendent informed us, that while their ordinary work continued to be done by the English system of measurement, their Willans engines are made by the metric system, and that the men, after a little opportunity to familiarize themselves with the new system of measurement, have no further difficulty with it, and like it better, find it more simple and easier to handle than the old system. Mr. Sellers' own experience is to the contrary; but we respectfully submit that even a very little experience, such as that of the Bullock Company's, goes far toward disproving the theoretical objections of those who have not tried both systems.

Some very queer arguments are brought against the adoption of the metric system, and in a contemporary of ours we recently noticed something like the following: "The millimeter is too large for fine measurements, while to divide it into tenths or hundredths would be virtually saying 'one one-hundredth of a thousandth of a meter,' a very clumsy expression, to say the least." This argument is precisely the same as though an advocate of the metric system were to say: "An inch is too large a unit for the finest measurements in machine shops, and to adopt a thousandth of an inch would be to say a thousandth of a twelfth of a third of a yard." But everybody knows we do not say anything of the kind; we simply say a thousandth of an inch, just as the other man would say one-hundredth of a centimeter. And yet, some of us wonder why those who advocate the metric system are not impressed by some of the arguments brought against it.

We certainly are opposed to any attempt to force the metric system into our industrial establishments. We are opposed to it because we think that if such legislation

could be enforced (which is exceedingly doubtful), it would be very unjust and would inflict great loss upon manufacturers. We believe it should be adopted, if at all, by just such steps as the Bullock and other companies have taken, and that if left to make its own headway in this manner, no one will be injured, for the simple reason that the change from one system to the other will be made by a large number of distinct individual steps in that direction, each step being taken because it is at the time economically advantageous. In the meantime, those who, from mere blind prejudice, misrepresent the position of the American Society of Mechanical Engineers on the subject, and those who bring forward childish arguments against the metric system, weaken the real argument against compulsory legislation on the subject, by enabling those who favor such legislation to show the absurdities of some of those who oppose it.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(36) H. G. H., Ware, Mass., asks how to demagnetize a pair of calipers. A.—Hang them from a twisted string near a strong magnet, and as they revolve from the untwisting of the string remove them gradually from the vicinity of the magnet. They should be opened out and revolve in the plane of their length.

(37) "Rubber Neck," Cleveland, O., asks: 1, How can I calculate in plain figures the sizes of pulleys to put on shafts to get a different speed from the main shaft? I must confess that I am a beginner at this part of the business, so that if you could get right down to the first and bottom principles, it would help me to start right. I can do simple arithmetic, but algebra is Greek, and geometry is Hottentot. A.—We will do our best to get our correspondent in on the ground floor. If we have two shafts, one being the driver and the other the driven shaft, and if the pulleys on each are of the same diameter, with a belt connecting them, then the speeds of the two shafts will be the same. If the pulley on one shaft is one-half the diameter of the pulley on the other shaft, then the speed of the shaft with the smaller pulley will be double that of the shaft with the larger pulley. If we have a shaft at 150 revolutions, with a 60-inch pulley driving a 30-inch pulley on another shaft, then the speed of the other shaft will be 300 revolutions. Here the speed of the first shaft multiplied by its pulley diameter is equal to the speed of the second shaft multiplied by its pulley diameter: $150 \times 60 = 9{,}000$; and $300 \times 30 = 9{,}000$. In all cases no matter what may be the speeds or the diameters, they must always at least have this relation to each other. The product of the speed and pulley diameter of either shaft must always be equal to the product of the speed and pulley diameter of the other shaft. Multiply together the revolutions and the pulley diameter of one shaft, and divide this by the revolutions of the other shaft if the pulley diameter is wanted, or divide the same product by the pulley diameter if the number of revolutions is wanted. With a shaft at 120 revolutions and a 48-inch pulley, what should be the diameter of a pulley on the other shaft to give 160 revolutions? $120 \times 48 \div 160 = 36''$. With a shaft at 140 revolutions and a 48-inch pulley, what would be the revolutions of the other shaft with a 28-inch pulley? $140 \times 48 \div 28 = 240$. In any of these computations it makes no difference which is the driver or which is the driven shaft. 2, How can I calculate spur gearing after the compound style to get a given speed from the main shaft? I want to use the gearing on a set of rolls direct from the engine, cutting the speed of the rolls down and also increasing the power of the rolls, but I want to get a certain speed on two sets. If you will tell me how to calculate it in plain figures, you will oblige me very much. A.—The same practice as followed about the pulleys above, applies also with the gears, only using the numbers of the teeth instead of the diameters. The revolutions of any shaft multiplied by the number of teeth in the gear that it carries, must equal the revolutions of the next shaft multiplied by the number of teeth in its gear. This would be correct for any number of shafts taken in pairs, one after the other, and it would be just as true for three or four or any number of connected shafts and their gears, taken all together. The product of the revolutions of the driving shaft multiplied by the teeth of each driving gear, one after the other, must equal the product of the teeth of each driven gear multiplied together and then multiplied by the revolutions of the last driven shaft or roll. With an engine shaft at 150 revolutions carrying a pinion of 32 teeth working into a gear of 96 teeth on the next shaft, and then a pinion of 24 teeth on this shaft driving a gear of 60 teeth on another shaft, and then a pinion of 12 teeth driving a gear of 60 teeth on the roll, what will be the speed of the roll? $(150 \times 32 \times 24 \times 12) \div (96 \times 60 \times 60) = 4$. It is quite convenient to put them in two vertical columns like this; we put the product of each column under:

Drivers.	Driven.
150	
32	96
24	60
12	60
1,382,400	345,600

Then, $1{,}382{,}400 \div 345{,}600 = 4$.

The reason for placing them in two vertical columns is for convenience of cancellation; and as we would actually perform the above operation, the case would finally look like this:

	150	96	
	32	96	3
4	24	60	
	12	60	5
		4	

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Gun-Making at Watervliet.

The Watervliet gun factory has been ordered to manufacture a 16-inch gun, which, on completion, will be shipped to the Sandy Hook proving grounds to undergo tests to determine the advisability of constructing this type of gun for coast defense purposes. It will weigh about ninety tons, and with a charge of 1,960 pounds of brown prismatic powder is expected to throw a solid steel projectile six feet in length and weighing 2,300 pounds over a range of ten miles. This will afford opportunity for fully testing the gun lathe illustrated and described in our issue of April 9, 1896.

During the last fiscal year there were completed at the Watervliet Arsenal ten 8-inch, nine 10-inch, and nine 12-inch guns, together with 10 5-inch siege rifles, ten 7-inch howitzers, and ten 3.6-inch field mortars, and several 3.2-inch field guns.

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Torpedo Tubes in United States Vessels.

Regarding reported changes that have been ordered in vessels of the United States Navy, which changes have caused some comment here and abroad, we learn that the Board of Construction, which consists of Chief of Bureau of Steam Engineering, Chief of Bureau of Construction, Chief of Bureau of Ordnance, Chief of Bureau of Yards and Docks, Chief of Office of Naval Intelligence, have recommended that no more bow or stern torpedo tubes be placed in any vessels, and further that those in present ships, excepting the "Brooklyn" (which are placed high), be removed when a favorable opportunity offers—when ship is undergoing repairs at some navy yard. With ships running at high speed, the bow and stern tubes have been considered unserviceable, and in some sense might even be a source of danger to the ship.

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Regarding our account in issue of March 4th, of a drill with oil tubes formed by milling grooves and covering them with a piece of sheet brass dovetailed in, a correspondent informs us that this idea originated with a machinist in the employ of the Whitman & Barnes Company, manufacturers of the diamond W. B. drill, in the summer of 1892, and has been a regular product of that firm ever since that time. Another correspondent, connected with the Patent Office at Washington, informs us that the same thing was described in a patent granted to C. W. Sponsel, of Hartford, Conn., March 3, 1891, though it was not claimed in this patent and was perhaps considered old at that time. This last-named correspondent cites also a patent in which the idea of broaching the teeth of gear wheels was covered, the inventor in this case proposing to do it by a machine constructed something similar to that of the Niles Tool Works, which we illustrated some time ago, except that it was arranged to work by hydraulic pressure instead of by a screw. This inventor is John L. Kunz, Milwaukee, Wis., and his patent was granted in June, 1894.

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There are rumors of a contest between the Carnegie Company and the Illinois Steel Company, said to be growing out of the offer of the latter company to furnish armor plate to the Government at the rate of $240 per ton, which offer led

to legislation fixing the maximum price of such plate at $300 per ton. It is reported that the Carnegie Company will undertake to drive the Illinois Steel Company out of business in rail making and other lines, and it is stated that representatives of the Carnegie Company, familiar with the business, claim that they can make steel rails cheaper than they can be made in any other establishment in the world, and that they will sell them at cost, if necessary, to succeed in the contest. Figures of cost have been mentioned as low as $11.85 per ton.

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We note that some opposition is being made to the appointment of Col. Hay as Ambassador to England, on the ground that he wrote "The Bread Winners." We do not know whether he did write this story or not; but its author, whoever he may be, is guilty of a slanderous misrepresentation of American workmen. In that story, which first appeared in the "Century," a wealthy idler, having nothing to do and steadily doing it, is made a hero, while every working man in any way brought into the story is made to appear as a fool, or a scoundrel, or both, and its author, whoever he may be, is not fit to represent the American people in any foreign country or in any way.

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It is announced that the new patent convention with Japan, which had been arranged for under the previous administration, has now been completed, and that part of it which relates to patents is as follows: "The citizens or subjects of each of the high contracting parties shall enjoy in the territories of the other the same protection as native citizens or subjects in regard to patents, trade marks and designs, upon fulfillment of the formalities prescribed by law."

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John A. Brashear, of Allegheny, Pa., has completed for Dr. Hans Hauswaldt, of Magdeburg, Germany, a spectroscope, which is the largest and most perfect instrument of the kind ever made, and is expected to add very materially to our knowledge of the physical make-up of the heavenly bodies.

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It is announced that the citizens of Ilion, N. Y., have raised $4,500, with which to pay the taxes of the Remington Arms Company, which was the condition under which the company's plant is to remain in that village for another year.

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George W. Davis, senior member of the firm of Geo. W. Davis & Co., machinists, Nashua, N. H., died in that city on March 12th. Mr. Davis was one of the inventors of the Davis-Bolling engine. He was in his sixty-ninth year.

Technical Books.

THE NAVAL ENGINEER AND THE COMMAND OF THE SEA. By Francis G. Burton. 231 4¼ x 7-inch pages. Published by the Technical Publishing Co., Manchester. Cloth. Price, 2s. 11d.

The author writes ostensibly as a champion of the engineer officers of the British Navy, and we shall not presume to criticise his treatment of British naval engineering matters, though, to an American, it seems in some respects decidedly queer—as, for instance, when he characterizes the official body of British naval engineers thus: "There can be no doubt that a spirit of antagonism to environment is engendered in any class which, by merely social or political distinctions, is kept outside the pale to which the individual attainments of its members entitle them. And this antagonism gives them an unduly exalted opinion of their own importance and of the value of the services rendered by their profession to the world." This seems to us to be mere rubbish. The very "attainments" to which Mr. Burton refers, the cultivated intelligence which their possession implies, are the elements which will act to disprove his remark that these officers "cherished the foolish notion that the ship was built for the purpose of carrying machinery rather than that the machinery existed for the mere purpose of working the ship." It is proper to say that Mr. Burton's attack upon the naval administration of Whitehall, and upon the ordnance authorities of the British Navy, seems to be based upon fairly just grounds, if his facts may be taken as trustworthy. When the author approaches the United States service, his treatment of the matter is, we feel bound to say, based upon either ignorance of what he writes about or a deliberate intent to misrepresent it. In fact, this portion of his book would seem to have been written rather in the interest of the "rule or ruin" faction of the line of the United States Navy, than in that of its engineers. His prejudice against our country is that of the ignorant and provincial Englishman—a type which, happily, is, among writers of note, rapidly fading in this enlightened age; and this animus is markedly accentuated when he considers our naval engineering and our naval engineers. Thus, speaking of the British cruiser "Terrible," steaming at full speed in a rough sea, he says, as to her machinery, that there was "none of that 'swimming in oil,' which American engineers so complacently appear to consider the acme of engine-driving," a criticism which, if it reaches our warships, will be received with hilarious derision there. Again, he slanders our corps of engineers in his statement that some of its officers had "anticipated the end of illness [due to overwork] by committing suicide." As to the question of military rank for engineer officers, which is being pressed vigorously in our naval service, it is difficult to characterize properly Mr. Burton's language when he says: "If you address a frog by the name of a bull, it will seek to swell itself out to one, and this was what the [United States naval] engineers endeavored to do." He is perhaps ignorant of the fact that our "frogs" and "bulls" come from the same social ranks, under the same system of selection, and are trained side by side at Annapolis; that neither our naval authorities, the press nor the general public would accept as correct such a definition of the relative importance of our engineer officers; and that, finally, his so-called "frogs" have not only, in the line of their immediate profession, won success the fame of which is world-wide, but some of them, leaving the naval service, have risen to eminence as occupants of chairs of engineering in our foremost universities, and in not a few other professions in civil life. In "The Death Struggle," which (in these days of arbitration treaties and of general good feeling between our own and the mother-land) Mr. Burton's misguided imagination leads him to describe as occurring between the fleets of the two nations, he further elaborates his distorted conception of military rank for engineer officers, as follows: "One of the Inspectors-General [an engineer officer] was with the [American] fleet, in chief direction of the engineering department afloat; he was not on board the Admiral's ship, apparently because on another vessel he could more ostensibly exercise the *independent authority* [italics ours] which he claimed," and, further, that, through the consequent "jealousy and friction," the Admiral's orders were not carried out "with the loyalty which, in naval and military manoeuvres, is so essential to success." As to this, it may simply be said that the Engineering Bill, now pending, which proposes the creation of the "Inspector-General" above referred to, has been reprinted, verbatim, by one of the foremost technical journals in England, and that from this reprint Mr. Burton has obtained, doubtless, the views which he exploits in this and other places throughout his book. There is nothing in this measure which would warrant the absurd condition which has been described; and such a characterization of its probable results does a serious injustice to its authors. It is either stupid or worse. It has been stated that this book would appear—as far as our navy is concerned—to have been written in the interest, not of engineers, but of the dominant faction of line officers. It may now be said that, in view of other statements by Mr. Burton, the officers of even that faction would scorn to use the arguments of a writer whose attack upon their country is so scurrilous. Any quotations from this book in support of any attack upon any branch of our service by any of its officers, would seem a supposition practically impossible to any intelligent American who glances over its pages. Thus,

in discussing the privateers licensed by our Government in his supposititious war, Mr. Burton says: "If the majority of them were desperadoes, if some of them had worked at Dartmoor and others lingered in Cuban or Mexican jails, they were none the less formidable on that account. . . . Sometimes the crews of the captured ships were taken prisoners; . . . sometimes they amused the victors by walking the plank. . . . Stories occasionally reached England, through some of the fugitives, of atrocities which seemed revivals of the deeds of Montbars, Mansvelt, Sawkins and Henry Morgan." Again, in announcing the English approach and victory over our fleet, Mr. Burton says: "There was much tall talk in Washington of a dash on Canada, whilst the drinking saloons of New York, Chicago and Baltimore were rife with suggestions for the destruction of the British power. . . . The victory was to the English; the American fleet was either captured or sunk, save one or two minor craft which escaped to their home-ports to tell the story of their defeat.

They came as fleet as forest deer;
We drove them back as tame.

There was wailing in New York and Washington when the news reached them, and an outburst of patriotic rage in the saloons." Mr. Burton's book contains much good material and much that is well calculated to interest and instruct those who would be informed regarding British naval affairs. We regret that it should be marred by its very unfair treatment of matters connected with our own navy.

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Death of Capt. S. D. Hibbert.

Capt. Stephen Decatur Hibbert, United States Navy, retired, died in Media, Penn., on the 12th inst., aged seventy-two. He was in the public service from 1847 to 1889. He began as third assistant engineer, and was with Commodore Percy on his expedition on the Susquehanna to Japan, in the fifties. At the outbreak of the civil war he was appointed fleet engineer of the Gulf Squadron at New Orleans. He was with Farragut at the capture of Vicksburg, in 1863. After the war he served as President of the Board of Examiners of Naval Cadet Engineers at Washington. Later he was President of the Board of Examiners of Naval Construction.

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It seems that a combination has been effected, or at least agreed upon, by some of the leading makers of steel-tired car wheels in the country, and the combination is to be controlled by a company known as the Steel-Tired Wheel Company, incorporated in New Jersey. J. E. French is president of the company.

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At this writing, it is reported that another serious industrial struggle is impending in England between the Employer's Federation on one side, and the Workmen's Society on the other, over the questions of the employment of unskilled workmen on certain machines, overtime, and rate of wages.

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Charles Brown, an engineer on the Panhandle Railroad, died on his engine while running on the 13th inst. The fireman fortunately noticed that something was wrong with the engineer and stopped the locomotive.

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Ball bearings are now applied to the reels on fishing rods, of course in the interest of the fisherman rather than of the fish, as in playing the fish the play is apt to be all on the rod end of the line.

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Personal.

Chief Engineer G. J. Burnap has been directed to appear before the Retiring Board at Washington.

Vernon F. Prentice and E. W. Whitmore, of Worcester, Mass., sail on Friday, the 19th, for Europe on a business trip.

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Commercial Review.

NEW YORK, SATURDAY EVENING, MARCH 13.

MACHINISTS' SUPPLIES.

The reports freshly obtained by us at the present writing show that the condition under which trade long has been laboring is as yet substantially unchanged. The experience of an exceedingly quiet business is far too prevalent to justify an affirmation that either the recent change of Administration or the oncoming of spring, or any other influence of stimulation is yet registerating its effect upon the market. If, however, an improvement should properly be looked for in the supply market only after it has become manifest in other walks of business, which is at least a question, too much stress ought not to be laid upon the present lack of it.

To be specific in stating unpleasant facts may not be consoling, but it is more satisfactory. Two of the concerns by whom our present conservative views are inspired may be considered the most important supply houses in the city. The proprietor of one of them tells us that there has hardly ever been such a quiet

(Continued on page 36.)

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Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Send $1 to the Tabor Mfg. Co., Elizabeth, N. J., for improved stop-motion revolution counter.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Mr. C. P. Anemaet, of the firm of Messrs. Hermann Glaenzer & Co., the well-known Paris engineers, agents of the Geo. F. Blake Mfg. Co., Niles Tool Works Co., the Wheeler Condenser & Engineering Co., the Ludlow Valve Mfg. Co., the Ajax Metal Co., etc., is now in the United States with one of their chief engineers. He solicits correspondence, and will be pleased to receive catalogues and pamphlets. Address care of Messrs. Glaenzer Frères & Rheinboldt, 26-28 Washington Place, New York.

(Continued on page 36.)

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Experienced draftsman wants position. Box 129, AMERICAN MACHINIST.

Draftsman, special mach., tools, shop and office experience; reliable steady man. Box 128, AM. MACH.

A mech eng, grad. of a Ger. univ., good math. and d'ftsman, wishes pos.; mod. salary. Ad. M. S.

Mach. draftsman wants situation; long experience; good ability; mod. sal. Box 117, AM. MACH.

Practical molder wants job—heavy engine, general jobbing, ship work, in loam, dry, or green sand; location immaterial. Box 127, AM. MACH.

Toolmaker, bldr. of mach. tools, special machy., also expt. on lathe piece wk., 18 years exp., wants position. Address Box 124, AMERICAN MACHINIST.

Wanted by a thorough prac. mech., die sinker and tool maker, pos. as asst. supt. or foreman; good manager of help and a hustler. Box 125, AM. MACH.

Mech eng. wants position; large experience in handling men and reducing shop to system and wk. to gauges; good references. "American," AM. MACH.

Open for engmnt, after April 1, a mach. shop supt. or foreman, familiar with high grade and accurate work; eng. work preferred; 10 years experience, A1 reference. Box 123, AMERICAN MACHINIST.

A middle aged mech. eng. with extensive exp. at designing light machy. and tools and familiar with the mfr. of tinware and hardware wishes to make a change. Box 126, AMERICAN MACHINIST.

Machinist, general foreman of heavy works, wants similar position, in shop that is run to make money; or to go on the road setting up engines. Address Box 122, AMERICAN MACHINIST.

Double entry bookkeeper, stenographer or traveling-salesman desires pos. Can furnish first class recomdtns as having served in above capacities. Nine years office exp. Address Clerical, AM. MACH.

A skilled designer and constructor with 25 years' exp. in labor saving and auto. mach. is open for engagement, or will undertake spec. work for mfrs. Unquestionable references from past and present employers and patrons. Ad. Box 71, AM. MACH.

Help Wanted.

Help Wanted—Good pay for leisure hours. Geo. W. Lord, Philadelphia, Pa.

Wanted—First class slotting machine hands. State experience and wages required. Apply Canadian General Electric Co., Peterboro, Ont.

Engineers out of employment can make good com by selling our new book The Practical Man. of Engines and Boilers. $2. Phila. Book Co., Phila., Pa.

Wanted—Number one foundry foreman, who understands melting iron and best way of getting out castings, modern shop. Pig Iron, AM. MACH.

Experienced superintendent wanted by a company manufacturing a large line of power presses, drops and rolling mills. Must be thoroughly up on modern machine shop practice. Salary satisfactory to the right party. Man of wide experience wanted. All communications treated strictly confidential. Address P.O. Box 827, Providence, R.I.

Wanted—A first class, sober, reliable field foreman, to build tanks, smoke stacks, water towers, etc. Must be capable of estimating costs on field work and keeping his labor within estimate. Would be located in New York and used in that city and surrounding territory. Address, stating experience, etc., Field Work, care AM. MACH.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Draftsmen's new conveniencies. D. J. Kelsey, New Haven, Conn.

The Dutton Wet Twist Drill Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Models, experimental and small special machy. built. Write to Crocker & Lawson, Binghamton, N.Y.

(Continued on page 36.)

(Continued from page 35.)

month with him as this will be, at the rate at which it is now going. The business coming in through his men on the road is such that he would bounce them all if they were not so old hands as to render it obvious that the cause of the difficulty lies outside of themselves. The other prominent house, whose trade right straight along in the past has apparently been much better than its competitors, reports that store business is not improving as compared with what it was some time since—in fact, they seem to imply the opposite. They do, however, detect some improvement in the business which comes by mail. Of course, we do not speak on the authority of these two concerns alone, but by a comparison of the experiences of a great many.

The power transmitting machinery business, like other lines of supplies, is quiet. A house which does one of the greatest amounts of business in that line reports some show of improvement this month, but it hardly seems illustrative of the market generally. There is something to be anticipated for power transmitting machinery sellers in connection with the May 1st moving time, which causes a little flurry of business in the spring.

The question of prices is one which perhaps is generally as indicative of business conditions as any. At present, in the machinists' supply line, these are unmistakably weak. Taking, for instance, power transmitting machinery, there has been a decline in cold rolled steel shafting, as our quotations will show. At least one of the wood pulley interests is shading prices. In rivets a decline has recently taken place. Twist drills while not, perhaps, quotably lower, are far from strong, as might be seen were the market tested by a large order. In the case of shafting it is said, however, that the reduction does not necessarily imply a slack demand; in fact, this is fairly good.

A few signs of improvement in the mechanical lines of trade have come to light. Some of the New England machinery builders are receiving better home orders. A certain shop in Newark, N. J., employing about 100 men, engaged in making saddlers' tools, etc., have been running full for a month past, which is the first time such a thing has occurred with it for so long a period.

SIDE LIGHTS ON EXPORT TRADE.

A matter which is frequently brought up in connection with our European trade in machine tools, is the question as to how far they are being purchased abroad for the purpose of imitation. Apparently the size and purposes of the orders received show that this is not the primary consideration, but that it is a fact that machines by American builders, especially when not protected by sufficient patents, are sometimes very closely copied by enterprising Eu-

(Continued on page 37.)

(Continued from page 35.)

Light and fine mach'y to order; models and electrical work specialty. E O. Chase, Newark, N. J.

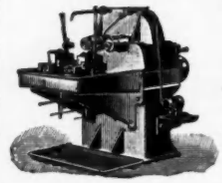
For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

For Sale—Garvin No 2 screw mach. wire fd., tools, fixtures, chuck: also B. & S. No. 2 U.M. mach., large stock cutters, mach. new, Jan. Box '30, AM. MACH.

Wanted—Every reader of this paper to send 35 cents for The Tool Catalogue. See Montgomery's advertisement on page 8 of this edition.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.



Automatic Solid Die Bolt
THREADING MACHINES.
Two Styles. Four Sizes.
Send for Catalogue "A."
Webster & Perks Tool Co.
Cor. Spring and Monroe Sts.,
Springfield, Ohio.

THREE GOOD BOOKS.

"GAS, GASOLINE AND OIL ENGINES."

By GARDINER D. HISCOX, M.E.

The only American Book on the subject.

Fully Illustrated. Large Octavo.

A book designed for the general information of every one interested in this new and popular motive power, and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer.

The book treats of the theory and practice of Gas, Gasoline and Oil Engines, as designed and manufactured in the United States. It also contains chapters on Horseless Vehicles, Electric Lighting, Marine Propulsion, etc.

PRICE, $2.50.

"THE MODERN MACHINIST"

By JOHN T. USHER,

Machinist. 322 pages, 257 engravings. A new book from cover to cover. It contains everything that the up-to-date machinist should know about his business. Practical, instructive, exhaustive. A valuable addition to the library and a reliable text-book for the machinist. Second edition.

PRICE, $2.50.

"SHOP KINKS."

By ROBERT GRIMSHAW.

This book is not like any other book on the subject. It shows special ways of doing work better, quicker, and cheaper than usual. It is full of pointers as to how work is done in the best American and European shops. It bristles with valuable wrinkles and helpful suggestions. It will benefit all, from apprentice to proprietor. Every machinist, at any age, should study its pages. It contains 400 pages and 222 illustrations, most of them directly contributed by eminent constructors. Every machinist needs it.

PRICE, $2.50.

*** Copies of any of the above, prepaid, on receipt of price.*

Send for our circular of recently published books, also our large catalogue of books for machinists and engineers.

HOW TO SEND MONEY.—Remit by Postal Order, Express Order, Registered Letter or by Draft on New York.

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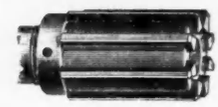
NORMAN W. HENLEY & CO.
PUBLISHERS,
15 Beekman Street, NEW YORK.



ADJUSTABLE REAMERS.
2 Styles Shell.
1 Hard Reamer.
SOLID AND SPECIAL REAMERS AND TOOLS MADE TO ORDER. Send for Catalogue of Small Tools, free.
R. M. CLOUGH, New Haven, Conn.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
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SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
SCHOOL OF PURE SCIENCE.

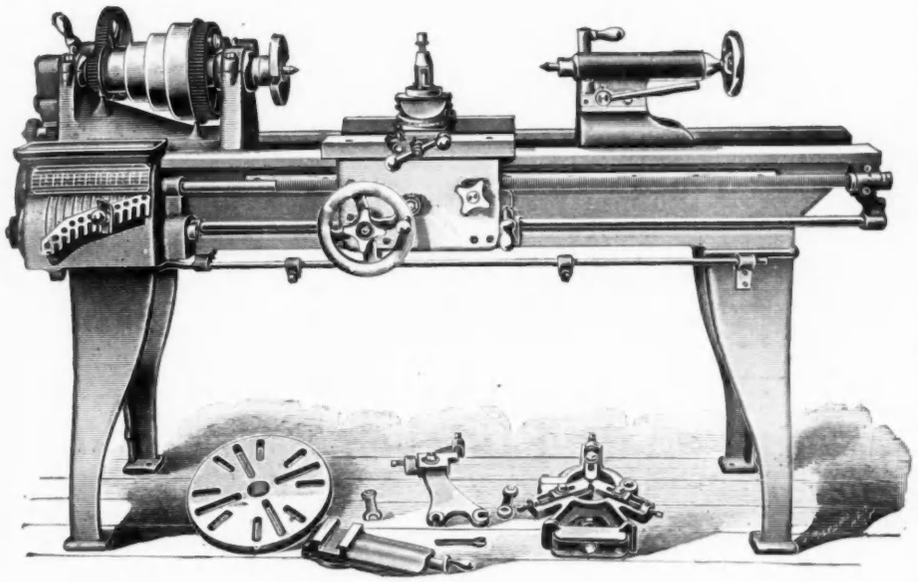
Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded on application to the Secretary of the University.

THE PARKER-WISHART-HALL CO.
STAMFORD, CONN.
MANUFACTURERS OF
Special Machinery.
MACHINE, TOOL, DIE and PATTERN WORK
OF EVERY DESCRIPTION,
EXPERIMENTAL AND MODEL WORK A SPECIALTY.
Engine and Machine Repairing Promptly Done.

LATHES

FITCHBURG MACHINE WORKS
FITCHBURG, MASS., U. S. A.
METAL-WORKING MACHINERY.
CATALOG E.

THIS LATHE COMBINES THE LATEST AND BEST IMPROVEMENTS.



14 in. x 6 ft. Hendey-Norton Lathe

With Improved Automatic Stop.

• • •

AUTOMATIC STOP

It is durable, simple, indispensable. It will automatically stop the carriage in either direction. It is equally efficient whether feeding or thread-cutting, running up to a shoulder, boring to bottom of holes, or internal thread-cutting. No danger of spoiling either tool or work. It is a safeguard against accidents in either direction.

CARRIAGE

The carriage reverses in apron; no slamming of countershaft. There is no comparison between this lathe and the old style or common lathe.

THREADS

It has all threads in daily use with simple movement of lever.

FEEDS

Has all feeds in daily use with simple movement of lever. Send for Circular.

• • •

THE HENDEY MACHINE COMPANY,

Torrington, Conn.

Agents for the Pacific Coast, PACIFIC TOOL AND SUPPLY CO., San Francisco, Cal.

European Agents, { CHAS. CHURCHILL & CO., Ltd., London and Birmingham. SCHUCHARDT & SCHÜTTE, Berlin and Vienna. EUGENE SOLLER, Basel, Switzerland.

(Continued from page 36.)

ropeans is shown by the following story, told by a witness of the incident. The Doe and Roe Company, well known to readers of "The American Machinist," had constructed a certain machine and had sold it abroad, but had omitted to take out Belgian patents thereupon. A representative of Belgian interests showed Mr. Doe a photograph of a machine made in Belgium and offered to sell it to him at a low figure. After looking at the photograph, "I know that machine!" exclaimed Mr. Doe, with some forcible remarks in addition. It was, indeed, identical with his own except for the name plate, and unsuspiciously offered to him, delivered in this country, at a lower price than that for which he was willing to sell it himself. Doubtless the American patent would have prevented the actual sale of the copy in this country.

In a late monthly volume of United States consular reports, Consul Tucker, at St. Pierre, Martinique, calls attention to the fact that much of the business which might fall to American merchants is lost because of their catalogs being printed in English only. He states that the municipality of St. Pierre desired to purchase one or more steam fire engines, and some stationary, but could obtain neither American catalogs or price lists printed in French. Our Genevan Consul also deplores the energy wasted in 1896, by American merchants and manufacturers who spread catalogs in English broadcast where French, German and Italian are spoken.

According to a Peruvian paper, "El Commercio," of Lima, a company capitalized at $20,000,000, has been formed for the purpose of developing various branches of industry in that country, including the construction of railroads, elevators, launches, etc. Their first line of railroad has already been surveyed by an American engineer.

Quotations.

NEW YORK, Monday, March 15.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $12 50
No. 2 foundry, Northern	11 50 @ 11 75
No. 2 plain, Northern	10 75 @ 11 00
Gray Forge	10 50 @ 11 00
No. 1 foundry, Southern	11 50 @ 12 00
No. 2 foundry, Southern	10 75 @ 11 00
No. 3 foundry, Southern	10 25 @ 10 75
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 50 @ 10 75
Foundry forge, or No. 4 Southern	10 25 @ 10 50

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.10 @ 1.25c. Store prices: Common, 1.40 @ 1.50c.; refined, 1.50 @ 1.60c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.60 @ 1.65c.

Cold Rolled Steel Shafting—Base size, 2.50 @ 2.55c., in small lots, from store.

Copper—Carload lots, Lake Superior ingot, 11⅞ @ 12c.; electrolytic, 11⅜ @ 11¾c.; casting copper, 11¼ @ 11½c.

Pig Lead—In carload lots, 3.40 @ 3.45c.,

Pig Tin—For 5 and 10-ton lots, 13.50c. f. o. b.

Spelter—In carload lots, New York delivery, 4.15 @ 4.20c., f. o. b.

Antimony—Cookson's, 7¼ @ 7½c.; Hallett's, 6¾ @ 7c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 39 @ 41c.

Manufactures.

At Lancaster, N. H., Mr. H. G. Moulton will make an addition to his car shop.

The Baltimore Enamel Company, of Baltimore, Md., will enlarge its plant.

At Nicetown, Pa., the Midvale Steel Works will erect a new shop, 100 x 35 feet.

White, Warner & Co., of Taunton, Mass., will erect an addition to their plant.

The machine shop of Leavitt & Mason, Hammond, Ill., has been destroyed by fire.

Mr. C. T. Fitzgerald, of Lewiston, Me., is going to build an addition to his mill.

The Pennsylvania Steel Company, Steelton, Pa., is building an addition to its plant.

The Youngstown Steel Works, of Youngstown, O., will erect a new casting house.

At Sedalia, Mo., the Missouri, Kansas & Texas Railroad will erect new car shops.

It is probable that the Parker Mills will erect a new mill some time this summer.

At Benwood, W. Va., the Riverside Iron & Steel Company will erect a new plate mill.

Singer, Nimick & Co. have purchased ground on which to erect a plant at Pittsburg, Pa.

William Steele & Son are erecting a new factory at 932 Race Street, Philadelphia, Pa.

The West End Street Railway Company, Boston, Mass., will erect a new power-house.

The Lovell Manufacturing Company, of Erie, Pa., will make an addition to their plant.

The Cincinnati, Hamilton & Dayton Railroad will probably erect new shops at Lima, Ohio.

The Nashua Manufacturing Company, Nashua, N. H., will place new boilers and enlarge its engine house.

At Bangor, Me., the Bangor Electric Clock Company is to be organized. General Joseph S. Smith will be general manager.

Peery Bros., of Salt Lake City, Utah, are to erect a new flouring mill, which will be equipped with new and improved machinery.

The Diamond Match Company has purchased the Eldred sawmill at Green Bay, Wis., which will be remodeled and machinery installed.

At Niagara Falls, N. Y., the Power City Foundry & Machine Company has been formed. Alex. R. Gow and John F. Anderson are interested.

The Ringrose Car Mover Company has been formed by C. E. Baldwin and others at Baltimore, Md., to manufacture a patent device for moving cars.

The woolen mill of Messrs. Phillips' Co., Adams, Mass., has been leased to Mr. Michael Glemin, of Dalton. It will be remodeled and new machinery placed.

The foundry of Farrell & Rempe, Chicago, Ill., was recently on fire, and damage to the amount of $50,000 resulted.

The Iowa Iron Works, Dubuque, Ia., where the torpedo Ericsson and revenue cutter Windom were built, has gone under the sheriff's hammer for $43,000. The plant cost $150,000.

The Hayward Company has been formed at New York, N. Y., to manufacture dredging machinery. Directors: Judson Hayward, of New York; Ed. C. White, of Mount Vernon, and Walter L. Pierce, of Scarborough.

The Sterling Machine Tool Company has been organized, under the management of H. F. Frevert, formerly with the Garvin Machine Company. The new company are located at 107 Liberty street, this city, and deal in machine tools, supplies and all lines of goods comprising machine-shop equipment.

The Cooke Machinery Company has suc-

(Continued on page 39.)

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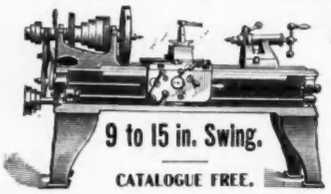

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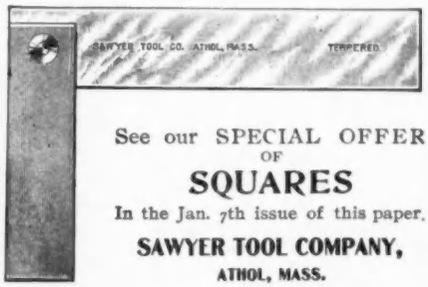

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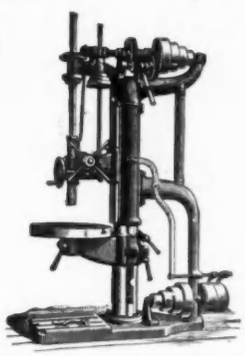

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(Continued from page 38.)

ceeded the firm of Cooke & Co., of 163 Washington street, New York, which a short time ago discontinued business. The new concern has for president J. J. Mullaney, and for vice-president R. H. Richards, both of whom were for several years with the Garvin Machine Company. The treasurer is B. J. King. They will handle a general line of machine tools, including the Cleveland automatic screw machines as a specialty; also the Connellsville blower and the De Loach saw and grist mill machinery.

The title of the Card Electric Motor & Dynamo Company, of Cincinnati, O., has been changed to the Bullock Electric Manufacturing Company. Mr. George Bullock remains president and treasurer of the company, and, in fact, all other officers are the same as before the change of title. In connection with this company, the Bullock Electrical Company has been organized, and its headquarters will be in the St. Paul Building, New York City. It is a partnership composed of George Bullock and Robert T. Lozier, and will be the selling organization for the first named company.

Theodore H. Colvin, of Providence, R. I., has commenced work on his new foundry building. The building will be 102 feet wide and 180 feet long, and will be a complete and modern foundry building in every respect. The central portion, 50 feet wide, will be served with a 20-ton traveling crane, and at distances of about 25 feet in the length of the building will be placed 5-ton jib cranes, swinging from the central portion of the building over the molding floors in the wings, which extend along both sides of the building and are 25 feet wide. The entire frame work of this building will be steel. The roof covering is to be slate. The steel work is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

We are in receipt, from John T. Burr & Son, Brooklyn, N. Y., of a catalog in which is described and illustrated the Burr Keyseat Broaching Machine. The catalog is 5¼ x 7 inches.

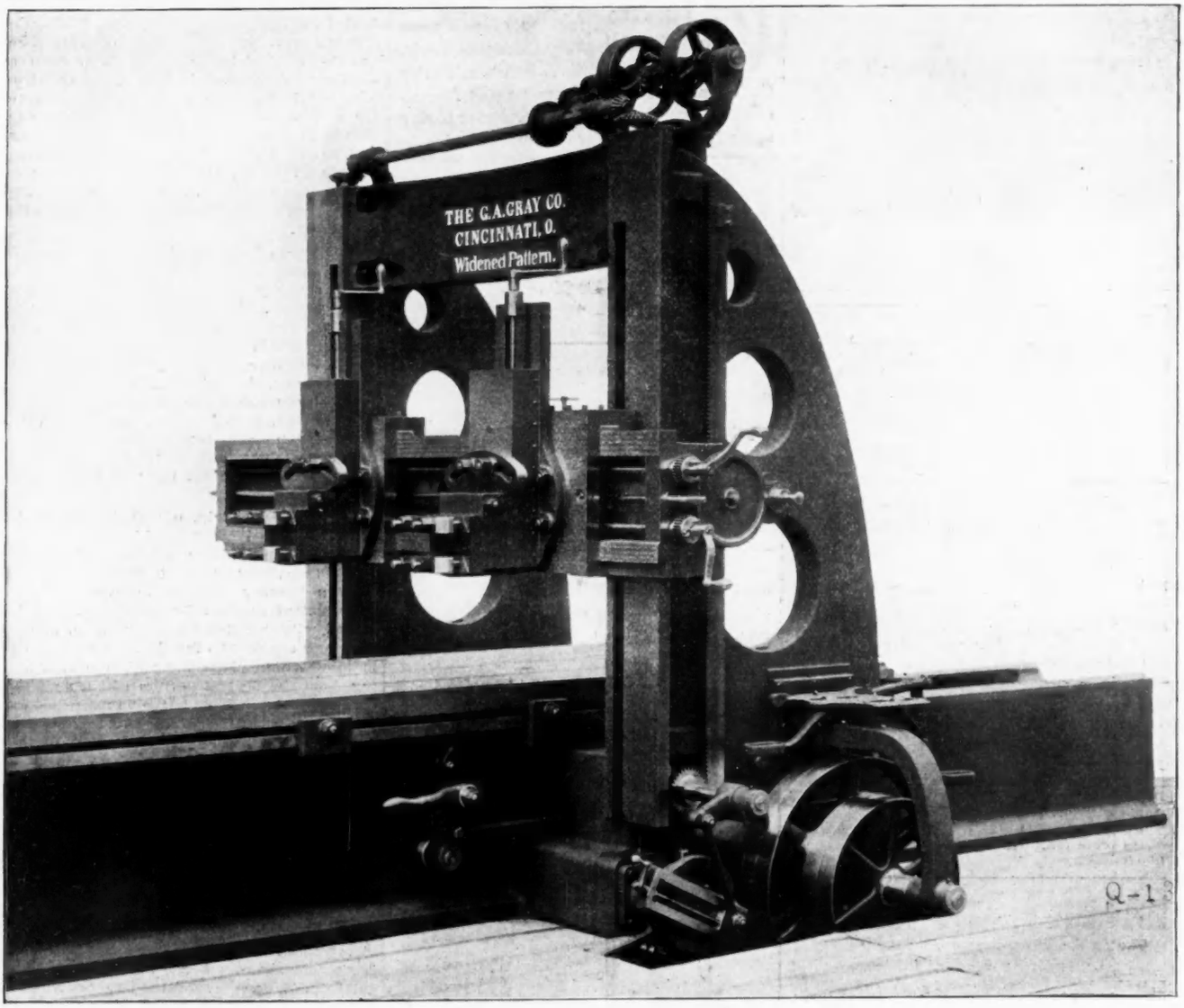
We have received from the Buffalo Forge Company, Buffalo, N. Y., a Spanish catalog, in which is given descriptions of various types of forges, blowing and ventilating machinery. It is 5½ x 7 inches.

We have received from the Bankers' Electric Protective Company, Chicago, Ill., a catalog devoted to the illustration and description of an automatic electric burglar alarm. The catalog is standard size, 9 x 12 inches.

The National Cycle Manufacturing Company, of Bay City, Mich., send us a catalog devoted to the description of the "National" wheel. Detailed description of the parts of this machine are given, and the catalog is 6 x 8 inches.

Theo. Alteneder & Sons, Philadelphia, Pa., send us a catalog which contains illustrations and descriptions of ruling pens, dividers, compasses of various types and other instruments used by draftsmen. The catalog is standard size, 2½ x 6 inches.

The Ball Bearing Company, of Boston, Mass., send us a catalog of ball and roller bearings for use in machine construction and line shafting. The catalog contains testimonial letters from those who have used and are using the bearings, and is 4 x 7 inches.



The above picture represents our New-Pattern, Standard 42" x 42" SPUR-Geared Planer, WIDENED to 54".
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60" x 48"	Widened from regular 48" x 48" pattern.
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72" x 60"	Widened from regular 60" x 60" pattern.
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The above Planers are furnished with one or two heads or rail, and with side heads on either one or both housings.

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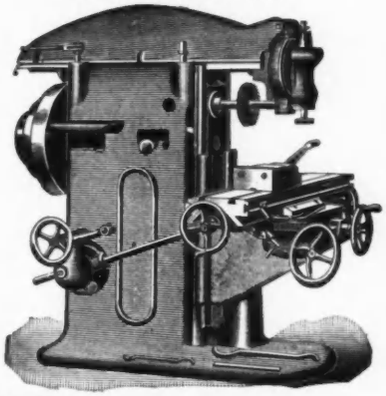

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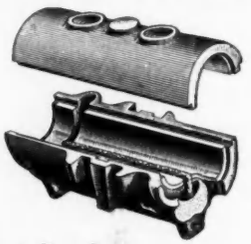

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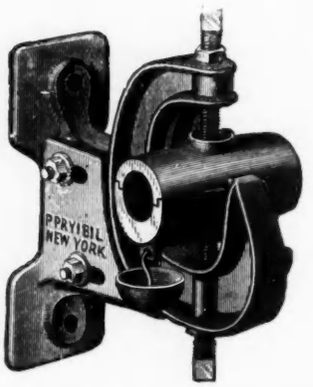

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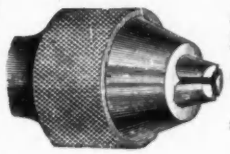

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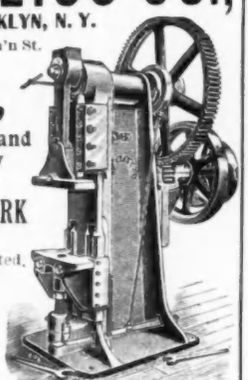

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SOLDERING FLUID.
Elliott Chemical Works, Newton, Mass.

SPECIAL MACHINERY.
Beaman & Smith, Providence, R. I.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Machine Co., G. J., Kalamazoo, Mich.
McMullin Mfg. Co., F. R., Chicago, Ill.
Mergenthaler & Co., Ott., Baltimore, Md.
Parker-Wishart-Hall Co., Stamford, Conn.
Toledo Machine & Tool Co., The, Toledo, O.

STEAM BOILER INSURANCE.
Hartford Steam Boiler Ins. & Insp. Co., Hartford, Conn.

STEEL.
Jessop & Son., Wm., New York.
Jones & Co., B. M., Boston, Mass.
McFadden Co., Philadelphia, Pa

STEEL, TOOL AND DIE.
Crescent Steel Co., Pittsburg, Pa.

TAPPING ATTACHMENT.
Beaman & Smith, Providence, R. I.
National Chuck Co., New York.

TAPPING MACHINES.
Garvin Machine Co., New York.
Hubbell, Harvey, Bridgeport, Conn.
National Machinery Co., Tiffin, O.
Woodward & Rogers, Hartford, Conn.

TAPS AND DIES.
McFadden Co., Philadelphia, Pa.
Reece Co., E. F., Greenfield, Mass.
Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield Mass.

THREADING MACHINES.
Webster & Perks Machine Tool Co., Springfield, O.

TOOL CATALOGUE.
Strelinger & Co., Chas. A., Detroit, Mich.

TOOL HOLDERS.
Armstrong Bros' Tool Co., Chicago, Ill.
Walker, John, Chicago, Ill.

TOOLS, FINE.
Standard Tool Co., Athol, Mass.
Sawyer Tool Co., Athol, Mass.

TRAMWAYS, OVERHEAD.
Coburn Trolley Track Mfg. Co., Holyoke, Mass.

TUBING, FLEXIBLE.
Almond, T. R., Brooklyn, N. Y.

TURRET LATHES (Screw Machines).
Bardons & Oliver, Cleveland, O.
Brown & Sharpe Mfg. Co., Providence R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Cleveland Machine Screw Co., Cleveland, O.
Davis & Egan Machine Tool Co., The Cincinnati, O.
Dreses, Muller & Co., Cincinnati, O.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Warner & Swasey, Cleveland, O.

VALVES.
Jenkins Bros., New York.
Kelly & Jones Co., New York.
Lunkenheimer Co., Cincinnati, O.

VENTILATING FANS.
Backus Water Motor Co., Newark, N. J.
Buffalo Forge Co., Buffalo, N. Y.

VENTILATORS.
Pancoast Ventilator Co., Philadelphia, Pa.

VISES.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York
McFadden Co., Philadelphia, Pa.
Niles Tool Works Co., New York
Wyman & Gordon, Worcester, Mass

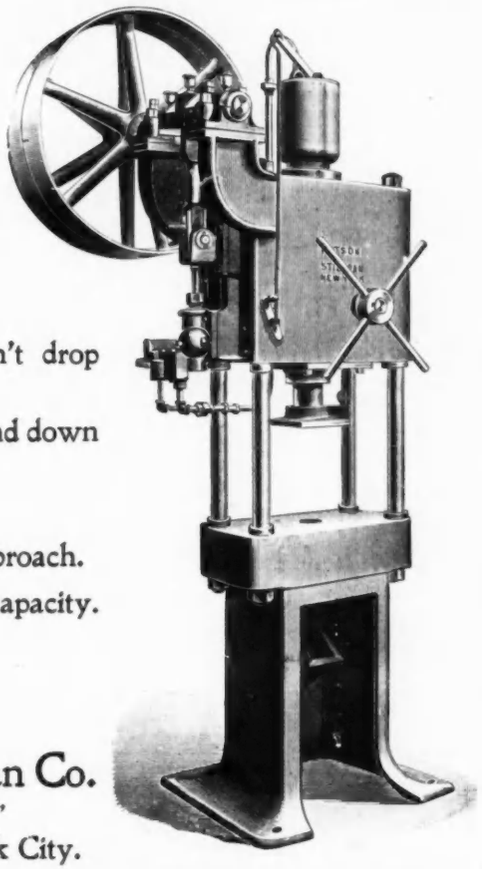
WATER MOTORS.
Backus Water Motor Co., Newark, N. J.

WIRE MACHINERY.
Adt & Son, John, New Haven, Conn
Goodyear, S. W., Waterbury, Conn.

WOODWORKING MACHINERY.
Bentel & Margedant Co., Hamilton, O.
J. A. Fay & Egan Co., Cincinnati, O.
Prybil, P., New York.
Whitney, Baxter D., Winchendon, Mass.

WORM GEARS.
Albro-Clem Elevator Co., Philadelphia, Pa
Morse, Williams & Co., Philadelphia, Pa

Broaching Press.



This cut shows the best Broaching Press we know about.

Strong, handy, quick.

Ram, counterbalanced—can't drop down.

Hand-wheel runs ram up and down independent of pump.

Double-acting pump.

Wood-lined pocket catches broach.

Two sizes, 30 and 60 tons capacity.

Opening, 13 inches.

High efficiency, low price.

The Watson-Stillman Co.

"Jackmakers to the Universe."

202 E. 43d St., New York City.

Barnes' Three-Spindled Drill.

This cut represents our new Three-Spindle Drill for light and medium work, the capacity being about the same as that of our 20-inch Lever Drill. The right-hand spindle is provided with combined lever and screw feed, and the other two spindles with lever feed. All three spindles have quick return. There is a graduation in speed between the spindles of 25 per cent. The distance between spindles is 10 inches; distance from center of middle spindle to column, 9 inches; fron center of outside spindle to column, 15 inches; size of table, 30 x 12 inches. The height of Drill is 70 inches; weight 800 lbs.

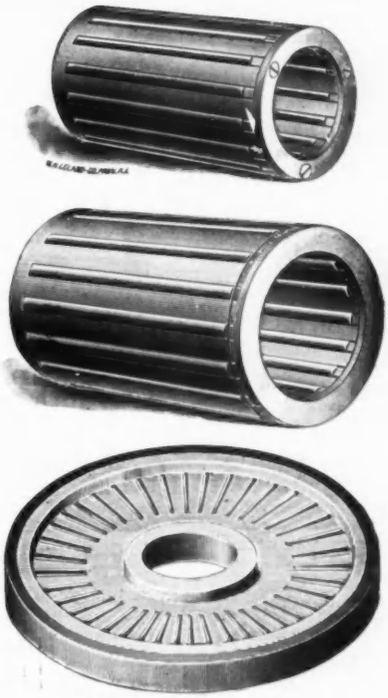
For further description we should be pleased to forward our catalogue describing our complete line of upright drills.

SEND FOR CATALOGUE.

W. F. & Jno. Barnes Co.,

1995 Ruby St., Rockford, Ill.

Chas. Churchill & Co., English Agents, London, E. C.



END THRUST BEARINGS.

Roller Bearings

REDUCE FRICTION AND SAVE POWER.

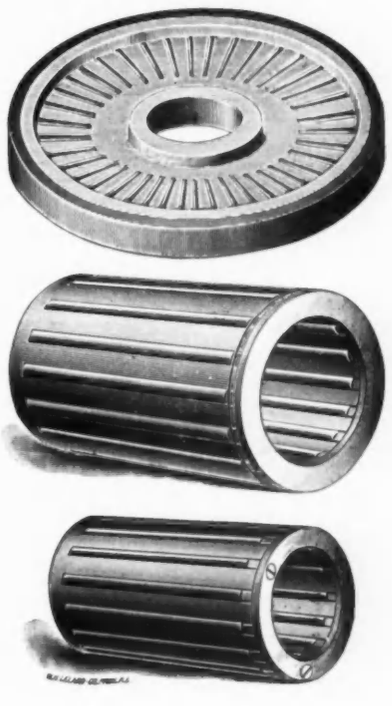
Applicable to all Classes of Machinery.

SEND FOR CATALOGUE.

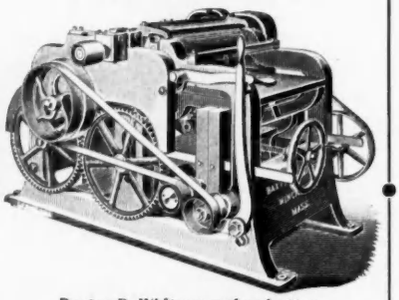
Mossberg & Granville Manufacturing Co.

PROVIDENCE, R. I.

END THRUST BEARINGS.



Planer Talk.



Baxter D. Whitney makes better planers than any other concern making wood-working machinery and stands ready to prove this to your entire satisfaction.

Baxter D. Whitney,
Winchendon, Mass.

SAVE YOUR EYES and use

COLUMBIA CALIPERS, No. 5.

64ths and even 128ths are read as readily and easily as *16ths on a rule.* I issue a little pamphlet **TELLS WHY,** which also shows a large line of Calipers in all standard graduations, Metric and Vernier System.

E. G. SMITH, Columbia, Pa.

FRANK BURGESS, Prop.
35 Hartford St., Boston, Mass.

1,100 Sizes, *Spiral, Worm,* Rack, Elliptic. Send for catalog.

BEVEL GEARS with planed teeth.

The Garvin Machine Co.

Spring and Varick Sts., New York.

Double Cup and Cone Grinder.
For Grinding the Ball Rods in Cups and Cones of circular form.

Manufacturers and Dealers in

Machinery and Machine Tools

Of Every Description.

COMPLETE LINE OF

Special Bicycle Machinery.

New Illustrated Catalog Printed in English, French and German sent on application.

HIGH GRADE MILLING MACHINES,

In Various Sizes; equal to any made.

KEMPSMITH MACHINE TOOL CO.,
Milwaukee, Wis., U. S. A.

ANY OFOU R AGENTS CAN TELL YOU OF THEIR GOOD POINTS.

J. J. Mc ABE, New York.
THE FAIRBANKS CO., Philadelphia, Pa.
STRONG, CARLISLE & TURNEY CO., Cleveland, Ohio.
SELIG, SONNENTHAL & CO., London, Eng.

The Hayden & Derby Mfg. Co.

Sole Manufacturers of

Metropolitan Injectors.

35,000,000 gallons of water are delivered every hour by

Metropolitan Injectors.

Recognized as the "Highest Standard in every country of the world." Send for book, Practical Information on Injectors, sent free.

Offices and Salesrooms:

111 Liberty Street, New York.

60 South Canal Street, Chicago, Ill. | 47 Pearl Street, Boston, Mass. | 424 Telephone Building, Pittsburgh, Pa.

Consolidated Nickel-Seat Pop Safety Valve.

For use on Stationary and Marine Boilers. There has never been an explosion of a boiler equipped with a Consolidat'd Valve. 200,000 in use.

Warranted to open at the pressure they are set at and to close tight after relieving boiler. No leakage.

Address Sole Manufacturers,

The Consolidated Safety Valve Co.,
111 Liberty Street, New York.

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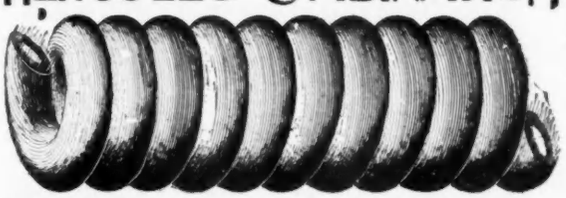
HERCULES COMBINATION



METALLIC STOP VALVE PACKING

Leaves the stem clean

Write for Testimonials.

Patented and Manufactured Exclusively by

PEERLESS RUBBER MFG. CO.

16 Warren St., NEW YORK.

16-24 Woodward Av., Detroit, Mich.
202-210 S. Water St., Chicago, Ill.

Fixing the Value of Things.

A piece of inch-and-a-sixteenth round steel two inches long is worth about four cents—in the rough.

Turned up for some commercial purpose, like a roller, it might be worth twenty-five cents. Ground to an accurate, one-inch plug-gage, it would probably be worth ten dollars.

It couldn't be worth ten dollars to a man looking for a roller to move a safe—it would be worth the ten to the right man—the man who wanted gages.

Yet to some people—and a few of them make machinery to sell—a piece of steel is a piece of steel.

That is, we suppose they think so by the way they reason about other things—for instance:

One of these men takes a notion to advertise, inquires the price of a page in a dozen papers that appear to him to be in his line. The lowest one quotes $9.98, and the "AMERICAN MACHINIST" $75—he measures the best by the cheapest. Then he says that the MACHINIST prices are out of all reason, and takes the cheaper paper—the rough piece of steel.

He advertises to reach the class of mechanics more familiar with plug-gages, gets meager returns, or none at all, and then, with his mantle of wisdom about him, pulls down the shutter of the window of experience and declares that "advertising don't pay."

He tried it and he knows.

The value of newspaper advertising space depends on its readers and the paper—make no mistake now, we mean the editorial excellence of the paper, the money and time, and pains and brains put into the reading columns of the paper. And on the readers it has gained, who respect it and read it and wait for it weekly.

Space in a paper composed of advertising and going only to advertisers wouldn't be worth seven cents an acre.

The slick advertising man may fool people into advertising in a weak paper for a while, but he can't keep it full of good advertising long—there has to be a foundation.

Work must be done on the lump of steel to increase its value, and the four-cent lump can be made worth ten dollars only by labor and care by experienced men who "know how."

The AMERICAN MACHINIST is in the plug-gage stage.

Don't compare its value with other papers by mere weight—the plug-gage weighs less than the lump of steel.

Use as much common sense in fixing the value of an advertising medium as you would use about your own business, and you can't go far wrong.

You know the difference between a piece of cold rolled shafting and a plug-gage.

No slick salesman could sell you one for the other, could he?

Well, then——

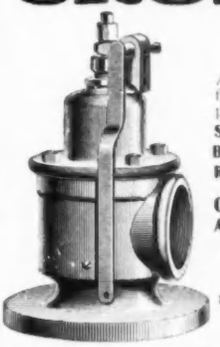
FOR ADVERTISEMENT OF
Morse, Williams & Co. Philadelphia, Pa.
See Issue of March 18, 1897.

PATENT YOUR IDEAS!
The simplest ideas if properly patented will frequently yield large profits.
PHIL. T. DODGE, Patent Attorney.
U. S. and Foreign Patents, Trade-marks, etc.
LOAN AND TRUST BUILDING. WASHINGTON, D. C.

Machinists' Fine Tools
STANDARD TOOL CO., ATHOL, MASS.
SEND FOR NEW CATALOGUE

FOR ADVERTISEMENT OF
TIGHT JOINT CO. NEW YORK.
See Issue of March 4, 1897.

CROSBY

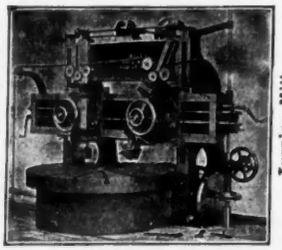


POP SAFETY VALVES.
Are a perfect protector from excess of steam pressure.
Steam Engine Indicator,
Branden Pump Valves,
Recording Gages.
CROSBY STEAM GAGE AND VALVE CO. . . . .
Main Office and Works,
BOSTON, MASS.
STORES—Boston, New York, Chicago, London.

Patents PROCURED or NO CHARGE for service. 32 Years' Practice. RELIABLE SERVICE at MODERATE RATES. Daily attendance in Patent Office. Good References.
CHAS. J. GOOCH, Attorney, 615 F Street, N. W., WASHINGTON, D. C.

PLANERS
LANER HAPER
FITCHBURG MACHINE WORKS
FITCHBURG, MASS., U. S. A.
METAL-WORKING MACHINERY.
CATALOG E.
SHAPERS

AUTOMATIC FRICTION CLUTCH CO. CATALOG ON REQUEST. 821 STATE STREET, ERIE, PA.


60-Inch Boring and Turning Mill.

The Best of the Labor Saving Tools.

Boring and Turning Mills,

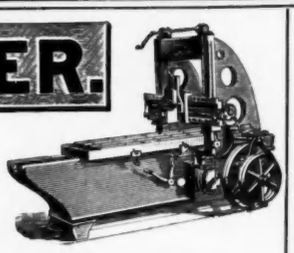
From 30 Inches to 30 Feet Swing.

Correspondence Solicited.

Branches: NEW YORK, CHICAGO, BOSTON, PHILADELPHIA, PITTSBURG.

THE NILES TOOL WORKS COMPANY,
Main Office and Works, HAMILTON, OHIO.

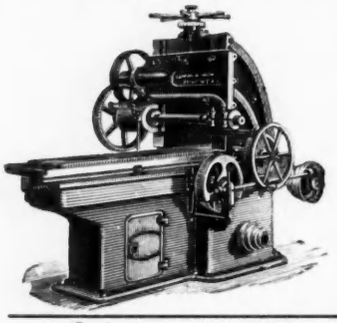
THE GRAY PLANER.



THE G. A. GRAY CO., CINCINNATI, O.

These Machines are sold by the following Agents:
HILL, CLARKE & CO., 14 South Canal St., Chicago, Ill.
STRONG, CARLISLE & TURNEY CO., 193 Bank St., Cleveland, O.
E. A. KINSEY & CO., 331 West Fourth St., Cincinnati, O.
THOS. K. CAREY & BROS. CO., 26 Light St., Baltimore, Md.
J. J. McCABE, 14 Dey St., New York City.
PACIFIC TOOL & SUPPLY CO., 102 First St., San Francisco, Cal.
SCHUCHARDT & SCHUTTE, Berlin, Vienna and Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.

HORIZONTAL SPINDLE MILLING MACHINE.



Intended for Long and Heavy Cuts.

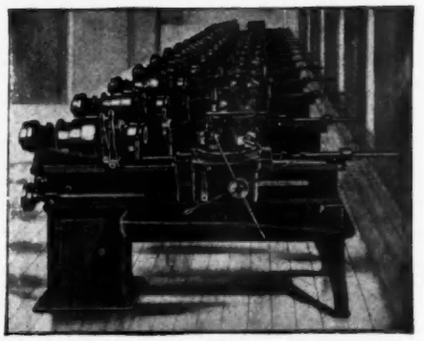
THE TABLE is 14 in. wide, 8 ft. long, surrounded by a trough to collect lubricant.

THE SPINDLE runs in bronze bearings 4⅜ in. in diameter, 5½ in. long, driven by a 3½-in. belt, over a 20-in. pulley geared 6 to 1.

CAPACITY between uprights, 19 in. Top of table to center of spindle, greatest 20 in., least 3 in. Can use cutters 8½ in. diameter. Weight, 8000 lbs.

◆ ◆ ◆

BEAMAN & SMITH, Providence, R. I.



2 x 24 Flat Turret Lathes

now ready for prompt shipment, equipped with complete outfit of tools, including the Automatic Die.

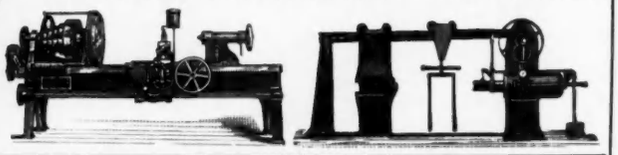
JONES & LAMSON MACHINE CO.,
Sole Builders and Sole Selling Agents for America.

Representative for *Germany, Switzerland, Austria-Hungary, Russia, Holland and Belgium:* M. KOYEMANN, Charlottenstrasse 112, Dusseldorf, Germany. *England:* CHARLES CHURCHILL & Co., Ltd., 9-15 Leonard St., Finsbury, London, E. C.; 6 Albert St., Birmingham. HENRY KELLEY & Co., 26 Pall Mall, Manchester.

William Sellers & Co. Incorp. PHILADELPHIA.

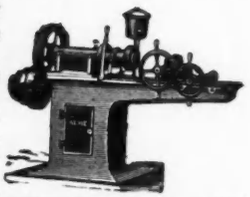
HAVE YOU EXAMINED?

THE NEW TOOL GRINDER, No. 2?
THE CENTRIFUGAL SAND MIXER?
THE VICARS' MECHANICAL STOKER?

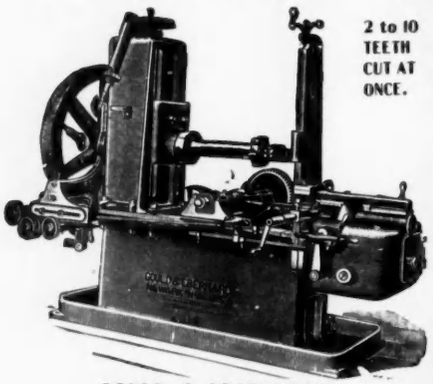


THE ACME Machinery Co.
CLEVELAND, O.

MANUFACTURERS OF ACME BOLT AND RIVET HEADERS, ACME SINGLE AND DOUBLE AUTOMATIC BOLT CUTTERS, cutting from 1-8 in. to 6 in. diam. ALSO SEPARATE HEADS AND DIES.



PATENT ENTIRELY AUTOMATIC
GEAR CUTTERS & "RADIAL DUPLEX" GANG CUTTERS



2 to 10 TEETH CUT AT ONCE.

GOULD & EBERHARDT,
NEWARK, NEW JERSEY, U. S. A.

AGENTS. JOHN LANG & SONS, Johnstone, Scotland; SCHUCHARDT & SCHUTTE, Berlin, Vienna and Brussels.

CLAYTON AIR COMPRESSOR WORKS
SEND FOR CATALOGUE. 26 Cortlandt St. NEW YORK.

ACCURACY

DON'T SPOIL IT
BY GUESSING.

Use the Richards' System of measuring machines; these Gauges are guaranteed to $\frac{1}{10000}$ of an inch.
Implements are adjusted at a temperature of 75°.

ASK FOR NEW RED BOOK.

The John M. Rogers, Boat, Gauge & Drill Works,
GLOUCESTER CITY, N. J., U. S. A.

ACCURACY ACCURACY ACCURACY

GRANT GEARS

GEAR WHEELS CUTTING

Grant Gear Works,
125 South 11th Street, PHILADELPHIA.
6 Portland Street, BOSTON.
86 Seneca Street, CLEVELAND.
Send for Catalog.

Wanted Catalogues and addresses of makers of the most improved Bicycle Tools, by Schuchardt & Schütte, Berlin C., Germany, Largest Importers of American Machine Tools in Europe. Refer to any large Machine Builder in America.